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MULTIDIMENSIONAL ANALYSIS OF ENERGY POVERTY IN FINLAND

Under the surface of a country with low energy poverty levels

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Contents

Tables and figures

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Abstract

The research aims to understand and quantify energy poverty in Finland in the context of political science and welfare policy. Energy poverty is a phenomenon with multiple potential causes leading to a wide range of policies needed in order to alleviate it. It is a phenomenon more recently recognized in academic research in the European aspect.

Two methodologies were used to research energy poverty in Finland. First a qualitative secondary analysis of previous research was conducted in order to recognize and categorize previously found causes and correlations with energy poverty. Based on the previously found correlations, assumptions on the risks of energy poverty were made due to the lack of actual energy poverty measurements in Finland. Second, a quantitative analysis was made in order to research the regional significance of each energy poverty cause.

The qualitative secondary analysis of previous research was successful in finding correlations and causes of energy poverty, or where the risk of energy poverty is the highest amongst the population. The regional significance of each cause was successfully quantified in Finland and assumptions were made where energy poverty or the risk of it is the highest.

In addition to recognizing the regional significance and risks for energy poverty in Finland, policy implications already in place are recognized and their effectiveness discussed.

Keywords
Energy Poverty, Poverty, Social and welfare policy

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Forskningens syfte är att förstå och kvantifiera energifattigdom I Finland inom ramen för statsvetenskap och välfärdspolitik. Energifattigdom är ett fenomen med flera potentiella faktorer som orsakar det. På grund av detta behövs ett brett spektrum av policy och politik för att lindra det. Energifattigdom är ett fenomen som nyligen fått mera fokus inom akademisk forskning i europeisk aspekt.

Två metoder användes för att undersöka energifattigdom i Finland. Först genomfördes en kvalitativ sekundär analys for att känna igen och kategorisera resultat för orsaker och korrelationer för energifattigdom inom tidigare forskning. Baserat på tidigare hittade korrelationer gjordes antaganden om vad som orsakar eller riskerar att orsaka energifattigdom. Detta behövdes på grund av att energifattigdom inte mäts i Finland. Efter kvalitativa sekundär analysen gjordes en kvantitativ analys för att undersöka den regionala signifikansen av varje faktor för energifattigdom.

Den kvalitativa sekundär analysen av tidigare forskning lyckades och gav korrelationer och orsak till energifattigdom. Den regionala betydelsen av varje faktor kvantifierades framgångsrikt och antaganden kunde göras för fenomenet i Finland.

Till slut diskuteras de politiska- och policyansträngningar som direkt eller indirekt redan tagits i Finland för att lindra energifattigdom.

Nyckelord
Energifattigdom, Fattigdom, social- och välfärdspolitik

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1. Introduction

Energy poverty as a phenomenon is most often associated with developing countries and more specifically rural areas where people have low incomes and living standards. As the matter of fact, there are currently 1.1 billion people living completely without access to electricity or modern appliances, with an estimate of 8 billion people with access to limited or unstable sources of electricity (World bank 2016). The reason for energy poverty in the developing countries is most often due to limited or no access to sources of energy, more specifically clean energy. The lack of clean and sustainable energy is leading individuals, regions and societies to lacking levels of safety, a large variety of health issues, low levels of development of the society and even challenges with education of individuals. In these areas, even the people with access to sustainable and clean sources of energy most often *do not have the funds to use them.* Energy poverty is being fought in developing regions by a multitude of different international organizations, such as World Economic Forum, International Monetary Fund, Global Environmental Facility, United Nations and multiple international fonds. In addition, many governments and supranational unions have intervened to fight energy poverty (Bouzarovski 2018, 2–3.)

Even though mostly associated with developing countries, energy poverty is not merely a challenge for the traditionally poorer countries, but also for countries more infrastructurally developed with access to electricity and other sources of energy. In Europe, an estimate of more than 50 million households suffer from energy poverty in some form (European Commission 2020a). In Finland, an estimate of 2% of the population is suffering from energy poverty (EPOV 2019) whereas European countries such as Bulgaria, up to 44% of the population experiences energy poverty (Bouzarovski 2012).

The events in France, November 2018, is a culmination of what energy poverty can lead to in Europe, as the *Mouvement des gilets jaunes* or “the yellow vest”-movement gathered to demonstrate on the streets of many cities in France. What ignited the movement and started a months-long political dispute and demonstrations was the government’s decision to raise tax on gasoline – resulting in higher energy prices. The people who took part in the demonstrations were mostly not considered as poor by the state but were people who

no longer had the means to get the energy they needed for normal use – getting to the grocery store or to work (BBC 2019.)

1.1. Scope of research

As shown above, there are many definitions for energy poverty. European Union defines it as a socio-economical issue, where an individual or a society does not have access to or the funds for electricity or energy (Official Journal of the European Union 2019). The European Commission Observatory for Energy Poverty in the European Union defines energy poverty households as ones that experience insufficient levels of access to or funds for important services such as heat, cooling, lighting or energy to operate domestic appliances that ensure decent levels of living conditions and health (European Commission 2020a). This is the definition that this research will be based on.

With the definition of energy poverty above, the study of it in the scope of political science is interesting and essential. The aim of political science is to describe political and societal phenomenon's, in order to understand the implications of them on individuals, societies, institutions and policies (Esaiasson et.al 2017, 20–21). According to the European definition, energy poverty is a multidimensional issue with socio-economic consequences on international, national and regional levels – not to forget the personal level, for the people suffering from it.

The scope of this research will be a multidimensional study to understand the possible regionality of energy poverty in Finland – and the implications it might have on the regions. The scope of the research will be limited to the research questions presented below:

Q1 – Which European indicators of energy poverty causes are valid in the Finnish scope?

Q2 – What is the regional significance of the causes of energy poverty – or the risk of them – in Finland?

Q3 – What are the implications of policies already taken, or not yet taken, in Finland?

This study will first in chapter 2 explain and describe energy poverty as a phenomenon, considering theories and aspects of political science in the scope of social and welfare policy on European and national levels

In chapter 3, will explain in more detail the chosen methodology for this paper, in addition to presenting the sources and data used for the study the methodology. The chapter will also present the operationalization of the research.

In chapter 4, a systematic secondary analysis of previous research on the different causes of energy poverty will be conducted. In addition, previous results on the consequences and policy implication will be discussed.

In chapter 5, the results from the qualitative research in chapter 4 will be quantified in order to research the significance of each previously recognized cause of energy poverty in Finland. The aim of the quantitative analysis is to assess the significance of the identified causes and their regional differences in Finland.The research is not a comparative analysis in a strict sense as energy poverty is not researched, measured or quantified currently in Finland. With the quantified analysis of the qualitative causes of energy poverty, a heat map of different regions and counties will be made.

Finally, in chapter 6 the study will discuss the results of the research, with the aim of describing and explaining the societal phenomena of energy poverty in order to further the understanding of energy poverty in the European context. The hope of the research is that the results can be generalized for further research (Esaiasson 2017, 27–29).

2. Explaining energy poverty

Since the impact of energy poverty is seen on supranational, national, regional and individual level – with different intensity and consequences – a large variety of research has been conducted on energy poverty. Traditionally research has focused more on issues and aspects of developing countries, with a focus on the complete lack of access to modern, clean, efficient and sustainable sources of energy. Recently, research has also been conducted and recognized as a topic in Europe, by different types of institutions that aspire to describe the theoretical aspect of energy poverty and to set clarity for the phenomenon. In Europe, governments and institutions have conducted studies to understand the extent and impact of energy poverty on their citizens, to understand the policy implications thereof. Non-governmental organization such as think-tanks, research groups and foundations have conducted studies aspiring to be advocates for the suffering individuals and to be the drivers of specific alleviations. Academic research has focused also on many aspects of describing, comparing and understanding the multidimensionality of this socio-economic phenomenon (Bouzarovski 2018, 3.)

2.1. Energy poverty in the scope of International Political Economy

International, or Global Political Economy (IPE) is the study that analyses economics, politics and international relations within the fields of macroeconomics, international business, international development and development economics. It is a study concerned of socio-economic issues and more precisely the impacts it has on international relations and vice versa (Broome 2014, 6).

The following three aspects build an understanding of energy poverty around the socio-economic issues of IPE.

2.1.1. Global poverty and development

International Political Economy presents theories of the complexity in alleviating energy poverty. According to IPE, the issue of energy poverty is culminating in the clash of societal issues and international economics. New technology and modern sources of

energy are often seen as keys in improving the lives of billions of people. In the view of international business, these are products of the private sector concerned with profit and economic growth. According to international political economy, the issue is between the conflict between political societal issues and international economic issues (Sovacool 2012, 273.)

In the global perspective, this is culminating as a bipolar issue with global development on the other end and global poverty on the other. Their situation for energy poverty globally is that one end of the pole has more people with modern access to electricity and the other with absolutely none (Sovacool 2012, 274.) Some trends of political economy see this bipolarity only growing.

In the aspect of poverty and development, also gender studies are of interest for IPE. Energy poverty affects both gender roles and all ages, both children and adults with economical, societal and health issues. The economic impact is commonly even among household members, but the societal and health issues are not. Limited or no access to modern energy may force individuals and households, usually women, to gather sources of energy for cooking and heating. Thus, due to energy scarcity, women become commonly more vulnerable for societal issues and will have less time and opportunity left for education and employment. Likewise, health issues and higher mortality caused by gathering of fuel and burning polluting fuels are causing women to be more vulnerable to short term health issues due to occupational hazards and long-term health issues due to inhaled pollution (Sovacool 2012, 277.)

2.1.2. Tax and welfare

In the view of IPE, a nation is as strong in international relations as its economy is. A nation's economy is built and strengthened by its citizens through international trade, development of the country, collected tax and growing welfare. A strong and wealthy nation will be strong in international relations (Broome 2014, 201).

Enabling the access to clean and affordable energy – fighting energy poverty – will have direct effects on economic security which on the other hand promotes development of individuals, societies, the nation and its international relations (Sovacool 2012, 272).

2.1.3. The environment and climate change

International political economy also studies the impact of the environment and climate change on socio-economic issues. In addition, it studies the international efforts to fight the climate crisis we are in. Fighting energy poverty will have direct positive impact on environmental issues and climate change – and vice versa. Environmental efforts often lead to cleaner energy produced locally. Locally produced clean energy results in lowering energy prices, as wind and solar already are becoming more competitive and cheaper than traditional fossil fuels. Locally produced electricity means that people will have access to it, and it becomes more affordable, thus removing the need to gather polluting fuels. Climate change and energy poverty alleviations go together (Sadath & Acharya 2017, 541.)

In addition to these three aspects, there could be explanatory theories based on resource competition and energy – but this would require a more focused study to be researched.

2.2. Energy poverty in the scope of Nordic social and welfare development

The Nordic welfare state is built on social democratic ideology where the strong take care of the weak and the working-class rules in a democratic and fair system where everyone has equal rights and opportunities (Isola, Turunen & Hiilamo 2016, 150). In the scope of Nordic social development, research is done in the topics of social science dilemmas such as democracy, welfare, poverty, gender equality, migration and various ethical and moral issues related to social development.

Some social scientists argue that the Ideology of the Nordic welfare state was impacted by the 1990’s recession. The number of unemployed citizens across the Nordics remain

high and poverty is and will remain a part of the society (Isola, Turunen & Hiilamo 2016, 150).

In the scope of Nordic welfare, energy poverty is a phenomenon that the state should be concerned about and offer alleviations. In Finland, there are welfare support schemes for vulnerable people (Gullman 2019, 5–10):

1. Social security:
    a. General housing allowance
    b. Housing allowance for the elderly
    c. Income support
    d. Repair allowance for housing for the elderly and disabled
    e. Social lending
    f. Church deaconess fund
    g. Guarantee fund

All these support schemes have been built with a general purpose of alleviating the challenges of vulnerable members of the society. In their general purpose, it is believed that these schemes are partly already responding to the issue of energy poverty (Gullman 2019, 5).

2.3. Energy poverty in the scope of European studies

Research executed by governments and supranational institutions have been mostly conducted not for building theories, but for quantifying the depths of energy poverty. In attempting this, they have in the process-built theories in taking assumptions of the indicators they have used for measuring the phenomenon. The main European driver for supranational and national research of energy poverty has been the European Commission observatory for Energy Poverty "EPOV", developed and founded in 2018 as a consortium of 13 organizations, including universities, think tanks, and the business sector – supervised by the European Commission (European Commission 2020b).

This chapter has contributed to the research with a theoretical aspect of energy poverty in orientations of political science. Energy poverty can be seen through multiple different interpretations as an international and economical issue, a social and welfare policy issue, a societal structure issue and an issue for EU energy policy – maybe even an opportunity for further EU integration.

In later chapters energy poverty will be viewed in two main categories to give the research a stronger aspect of political science. The causes and policy implication of energy poverty will be considered as ones that can be impacted by policy efforts directly and ones that cannot. Each cause and policy will be divided in the two factors to understand where the issue today is in the view of political science.

3. Multidimensional methodology for research

When conducting research in political science, it is important for the research to answer questions that relate to social issues that are current, valid, relevant and interesting (Peters, 2012, 325–326.)

The following research questions have been chosen to represent these requirements:

Q1 – Which European indicators of energy poverty causes are valid in the Finnish scope?

Q2 – What is the regional significance of the causes of energy poverty – or the risk of them – in Finland?

Q3 – What are the implications of policies already taken, or not yet taken, in Finland?

The above-mentioned research questions are current, because of the only recently grown interest from regulators to understand and alleviate energy poverty issues in Europe. This interest has sparked new research, new organizations and new understanding for the phenomenon across Europe.

The above-mentioned research questions meet the requirement of being relevant, because many member states have just recently recognized the issue and applied measures to fight energy poverty. Finland is one of the countries where it still has not been recognized by regulators, with the belief that the issue is not significant.

In order to answer the questions above, the research will be operationalized with a systematic qualitative secondary analysis of previous research results on the causes and indications of energy poverty. The secondary analysis will lead to a quantitative analysis to research the significance of the energy poverty causes and indications in the Finnish scope. The significance of each cause and indication of energy poverty will be researched in a regional perspective.

Aim of the research is to recognize which of the causes of energy poverty recognized in Europe apply in Finland, and to discuss the policy actions already taken directly or indirectly.

As a result, this research will be able to present the known causes and policy implications – and in addition recognize the issues that might be in the unknown today.

3.1. Secondary analysis of previous research

First a systematic secondary analysis of previous research will be made in order to recognize the causes and indicators for energy poverty. According to Sage research method definitions:

> *"Secondary analysis is the re-analysis of either qualitative or quantitative data already collected in previous study, by a different researcher, normally wising to address a new research question."*
>
> Sage (2020)

The secondary analysis will summarize and highlight the most important results in previous research. The analysis is made in order to find what causes and indications have previously been found in association of energy poverty as the key variables and their effects as assessed in previous research. The aim of the qualitative secondary analysis will be to first recognize the causes and indicators of energy poverty. Secondly, the qualitative research will be made to categorize the explanatory factors of energy poverty in order to build valid hypotheses for the quantitative phase of this research.

Systematic qualitative secondary analysis will be operationalized with the following questions:

Question 1 - What causes energy poverty in Europe?

Question 2 – What are the policy implications of the causes?

Question 3 – What are the recognized policy implications for Finland?

One of the most important attributes for qualitative research is empathetic neutrality, with the assumption that full objectivity is not attainable (Vromen 2007, 257). Neutrality will be striven towards by the choice of data and reference literature, in order to represent a wide range of views and understandings. The language of the research will be kept as

neutral as possible, without taking the side of regulators, previous researchers or individuals experiencing energy poverty. The final chapter, chapter 6, will be used as the opportunity to share and reflect personal thoughts and views.

3.2. Quantitative analysis of indicators

The secondary analysis will summarize and highlight the most important results from previous research in order to find what causes and indications have previously been found in association of energy poverty. After the qualitative secondary analysis, a quantitative research will be made to build upon previous research. The purpose of the quantitative research is to assess the significance of factors and indicators identified in the qualitative analysis, which will be presented in the form of hypotheses. The quantitative research will eventually give answers to the second research question "What is the regional significance of the causes of energy poverty – or the risk of them – in Finland?".

As a disclaimer, this research will not be able to strictly *confirm or falsify* the previously found hypotheses in the Finland, due to lack of energy poverty as a variable, which will be addressed and discussed later. Instead, this research will study and discuss the significance of each factor and their potential impact as indicated by the hypotheses. The factors are analyzed both on the national and regional levels in Finland. The research will be able to make assumptions, based on previously found correlations and expectations for energy poverty.

First, the significance of each indicator in the Finnish scope will be discussed. Second, the regional significance of each indicator within Finland will be researched.

The quantitative research will be done in order to assume, based on previous research, where and why citizens in Finland are either under the highest risk of suffering of energy poverty – or might in fact already be suffering in various levels of energy poverty.

Finally, based on the results from the quantitative analysis, the research questions are discussed. The results will be discussed to understand direct and indirect policy implications already taken in Finland – or recognized by research as needing more

attention in Finland. The importance of the policy implication discussion is high, since some of the indicators might show high risk in some regions but might already be indirectly covered by government assistance.

3.3. Data and literature

The material used and referenced to in academic research should be primary literature, non-fictional facts literature and without the authors personal opinions. In addition, academical articles and research reports from academics, researchers and legitimate organizations can be used (Vromen 2007, 262–263.)

Four main criteria will be used in the selection of literature in this research (Vromen 2007, 263–264) with the following operationalization used when striving to meet the criteria:

1. Authenticity, which means that the literature referred to are original published writings and research results from real academics and institutions.
2. Reliability, using literature sources that come from well-established and honest institutions and academics that strive to produce high quality research.
3. Representativeness, meaning that a research should strive to as accurately as possible reflect what the results are and in an objective research, deliver multiple views for an open discussion.
4. Significance, meaning that the literature referred to should be considered important and valid, for what it is referred for. In addition, the reason literature is referred to should have a specific and clear purpose, which is to confirm a truth or statement made in the research.

In order to meet the above-mentioned criteria for the reference literature in this research, only officially published and found documents from authentic academics and institutions will be used. Each reference used will be checked and researched to confirm that they are reliable sources. To strive for openness in this academic research, all literature used in this research will be gathered as a list of references in the end of the research.

The secondary analysis will study previous research from the following sources:

- Academical publications in Europe and elsewhere
- Studies and reports published by the EU
- Studies funded by the EU
- Studies and reports conducted by the Finnish government

It is easy to argue that the abovementioned EU- and national documents, together with previous academic research meet all the four points of reference literature criteria. The study has also views included from EU funded research projects, which can be argued not to meet the requirement of academic authenticity due to possible organizational interests. These sources have been included to add color to the discussion and additional views. When referred to, these will be critically discussed in the research.

The quantitative analysis will build upon previous research by analyzing data found from Statistics Finland. This data is accurate, authentic and highly reliable. The purpose of the quantitative research is to assess the significance of factors and indicators identified in the qualitative analysis, which will be presented in the form of hypotheses. The quantitative research will eventually give answers to the second research question "What is the regional significance of the causes of energy poverty, or the risk of them, in Finland?".

Even though the accuracy and reliability are high for the data from statistics Finland, the significance aspect is challenging due to two factors related to regionality and energy poverty.

The first challenge with the found data is that the regionality level of the data varies and most often does not exist on communal level. For the most part, Statistics Finland has gathered data only on the county level, explained in more detail in chapter 5.

The second challenge with the data is as the report by the Finnish Ministry of the Environment concludes, data on energy poverty is currently lacking in Finland (Ympäristöministeriö 2015). This is also something that the EU funded research project Assist2Gether found out, energy poverty is not measured or even recognized in Finland

as a phenomenon (Assist2Gether 2019). Also, previous thesis work has recognized the same issue (Gullman 2019). We can thus conclude that the data gathered by Statistics Finland does not comply with previous methodologies created by academical researchers. An accurate measurement of the regionality of energy poverty cannot be made be due to the lack of important data points.

Due to these two arguments, the research has not been able to answer with certainty where the hotspots for energy poverty in Finland are, but rather discuss the best possible estimate based on indicators found in previous research.

Other sources of data were recognized, such as data provided by the European Commission observatory for Energy Poverty, stored at the Eurostat EU-SILC survey data base (EPOV 2019). The data was not chosen to be used in this research due to two factors. The first factor was that the data provided by the observatory is only on the national level and is mostly for the comparison of member states and for understanding the general development of the issue on European level. The second factor for not utilizing this source was that the Finnish national sample rate n was too low to be used as a reliable data source for building hypotheses (Eurostat 2020).

4. Causes and indicators of energy poverty according to previous research

Measuring energy poverty is a challenging task. There is a multitude of multidimensional indicators and methods for measuring energy poverty levels. It is a private issue that can be seasonal and specific to one aspect of a households living.

Nevertheless, it can be a significant burden, causing health issues, inequality, pain and suffering. Previous studies seem to all be aligned that in order to recognize energy poverty or at least the risk for households, regions or socio-economic groups suffering from energy poverty – a comparative research with the national expected median should be made.

Three main methods are summarized by Bouzarovski (2018, 14):

- Examining the level of energy services in the home, such as heating, cooling, transport, refrigeration, cooking, etc. to measure and compare their adequacy to the expected national standards.
- Analyzing patterns of energy expenditure to recognize deviations from national standards and expectations.
- Making analysis of housing circumstances to recognize domestic energy deprivation.

In this chapter, we will discuss and summarize the previously recognized causes of energy poverty and reflect how they could be measured in order to recognize regions and socio-economic groups in risk of energy poverty in Finland.

4.1. Previous research on the causes of energy poverty

4.1.1. Poverty and deprivation

The European Union recognizes general poverty and deprivation, which are commonly measured and tracked indicators in the European Union, as one of the main causes for energy poverty.

Research and some governments suggest that is not as straight forward. In Great Britain, the government is not merely looking at the definition of poverty to recognize individuals who might suffer from energy poverty but define energy poor or deprived individuals as ones with "low income, high cost" – where the cost of energy is half of the individuals income. The European Commission observatory for energy poverty is measuring this in a more generalized manner, and recognizing individuals being in risk of energy poverty due to costs as the percentage of the population with absolute energy expenditure more than twice the national median income.

These vulnerable groups, recognized by having low income and high cost of energy either have high energy costs of compared to their income levels, or have higher energy costs than the national income, which can be caused by multiple other underlaying reasons described later.

These individuals are not necessarily always living in energy poverty, but most likely suffer from some level of energy deprivation and are in high danger of falling into energy poverty. In Great Britain these vulnerable individuals are most commonly found in the socio-economic groups of:

- Unemployed
- Students
- Senior citizens or pensioners

The Assist2Gether-program aims to explain the causes of energy poverty through a combination of three factors; high energy bills, low income, and poor energy efficiency. The theories for measuring energy poverty according to Assist2Gether-program are through different indicators within these factors:

The combination of high energy bills and low income measures the level of household's energy affordability by the following indicators (Assist2Gether 2018, 10):

- Income
- Energy prices
- Energy consumption (level)

The comparison between the cost of energy and income helps us define and recognize people suffering or being in danger of suffering from energy poverty. What the comparison lacks is the explanation and reason as to why their energy expenditure is high. This is something that the Assist2Gether study aimed at answering through their energy efficiency indicator and is something that will be discussed in more detail.

Based on previous research on vulnerable customers, we can identify two hypotheses for our quantitative regional analysis:

H01: Risk of energy poverty is high among the vulnerable or low-income citizens

H02: Risk of energy poverty is high amongst the elderly

The hypothesizes will be quantified and analyzed in chapter 5.

4.1.2. Living far

One cause for energy expenditure being higher than the national median, is living further away from services. Fuel prices do not only have impact on the cost of heating or electricity, but also transport (Berry et.al 2016, 16–18). In sparsely populated regions the distance to work, school, healthcare and stores can be long and with limited or no access to public transport. When the cost of fuel rises, or the needed amounts of fuel grows, individuals and households may face challenging issues to travel where needed. This may cause their fuel expenditures to raise higher than is healthy for the economy of the household when compared to their income levels (Berry et.al 2016, 8).

This is something that was recognized in the study made by Papada and Kaliampakos, where they recognized the regionality of energy poverty in Greece, where energy poverty impacted the people living in the distant mountainous regions the most (Papada & Kaliampakos 2019, 765). This is also the aspect recognized in the *Mouvement des gilets*

jaunes or “the yellow vest”-movement gathered to demonstrate on the streets of many cities in France in November 2018. The people partaking in the demonstrations were mostly living on the outskirts or on the countryside, having challenges to afford fuel in order to go to work or get groceries already before the government’s intentions to raise the tax (BBC, 2019).

The Finnish Ministry of the Environment has also recognized this as a potential risk for energy poverty. The ministry is flagging regions with long distances and the cost of energy in transport as high risk for suffering from energy poverty (Oja, Vaahtera, Vehviläinen, Ahvenharju & Hakala 2013, 23).

Based on the previous research on high energy costs due to long distances, we can recognize the following hypothesis for our quantitative research in chapter 5:

H03**:** the risk of energy poverty is high in households living in the sparsely populated areas.

4.1.3. Sources of energy and energy prices

The second reason an individual can have higher energy costs than the average of the population is the sources of energy they have access to or are able to utilize as fuel.

Sadath and Acharya (2017) research energy poverty and the different impacts it can have on the society and the individual through the aspect of capability in India. What they found was that energy poverty can be caused by a household’s capability to utilize clean, sustainable and affordable energy (Sadath & Acharya 2017, 544). The study shows that the access to different sources of energy may have a strong impact on energy poverty and its consequences. Households and individuals forced to use imported fossil fuels can be impacted strongly by national and global political developments, that have direct or indirect impact on the prices of energy.

Even though people in the western societies do not demand or consciously buy energy per se, they need it for services that we all take for granted until they are not available. These are daily used services such as transport, cooking, washing, heating and cooling. One of the reasons energy poverty should be a separate defined policy issue is, that for individuals to receive clean, affordable and sustainable energy – they need to be available. For them to be available, the correct political decisions need to be made for the

infrastructure of distribution, import of fuels, manufacturing of power systems and offering of modern energy efficient appliances (Bouzarovski 2018, 15). In addition, the impacts of national energy policies regarding self-sufficiency, renewable production and other new technologies, together with resource competition and other international political impacts may directly or indirectly be seen at household level (Bouzarovski 2018, 16). Household energy consumption is only a small part of a complex ecosystem infused with technology, capitalist competition and national interests.

The second study conducted in Finland, by the Ministry of Environment in 2015, also found similar expectations for the individuals in risk of suffering from energy poverty in Finland. The research was conducted amongst low-income households living in detached housing. As a result, the ministry found out that 60 000 – 100 000 households are under the risk of falling into energy poverty based on their source of heating. These households were recognized as the low-and mid-income households living in oil heated homes (Ympäristöministeriö 2015). On the contrary, the ministry recognized that the least likely to suffer from energy poverty were multi-apartment buildings with central heating systems such as district heat (Runsten, Berninger, Heljo, Sorvali, Kasanen, Vihola & Uotila 2015, 3).

In the UK, the definition of a energy or fuel poor household is one with "low income high cost" or "LIHC". This is a household that is considered poor if (i) the required fuel usage or costs are above the national median and (ii) spending the national median in fuel – or the amount they would actually require – would leave them with a residual income below the official national poverty level (Bouzarovski 2018, 10). This measurement was not completely successful and has met controversy in not managing to measure all the factors of energy poverty.

Based on previous research on energy sources in domestic use, we identify two hypotheses for the quantitative research in chapter 5.

H04: Risk of energy poverty is high in homes with oil heating

H05: The comparison of energy price development with the development of income levels may show the most vulnerable socio-economic groups. In addition, it will tell if the price development is indicating that the issue is growing.

4.1.4. Energy efficiency & housing

The third possible cause for having higher energy costs compared to the national median was already touched on in the previous chapter – energy efficiency and other housing related issues. In a study conducted in 2018, Gouveia et. al researched the possibility of an indicator revealing the level of energy poverty. The hypothesis was that an energy gap between the energy need a household is estimated to require and the actual energy consumption can be measured as an indicator. The larger the gap, the more likely the household is suffering from energy poverty (Gouveia et. al 2019, 190–191). They concluded in their study that the most vulnerable building types for energy poverty are ones that have a high energy need and low energy efficiency. Gouveia et. al stated that these building types include houses with different housing faults or defects, houses with bad insulation which was recognized most commonly among old housing and the source of heating in the homes, which was already discussed as a separate cause for energy poverty (Gouveia et. al 2019, 192).

In the European Union, energy efficiency is widely recognized as a potential cure, or at least alleviation to energy poverty. Energy efficiency thus gets attention through various research and assist projects within the EU. Energy efficiency in general has also been a clean energy scheme in the EU 2020 goals, where each country was to raise the general level of energy efficiency within each member state (European Commission 2010b).

One of the before mentioned research and assist projects, Assist2Gether (2018, 9–10) considers the following housing types and faults when trying to recognize causes for energy poverty:

- Tenure system
- Housing characteristics
- The combination of poor energy efficiency and high energy bills measure energy use patterns of households by the following indicators:
- Energy consumption (type)
- Type of heating system & share of central heating

The first study of energy poverty in Finland, conducted in 2013 by the Ministry of the Environment was made in connection to a general research of energy expenses of

households in Finland. During the research, energy poverty was generally reviewed and evaluated. The researched concluded that energy poverty in Finland impacts a low percentage and is mainly impacting households living in buildings with low energy efficiency (Oja, Vaahtera, Vehviläinen, Ahvenharju & Hakala 2013, 13–15).

EU funded assist groups like for example Transition zero, Combi, Reach and FIESTA all research and assist vulnerable households through energy efficiency schemes and programs. All projects aim to better the living conditions of households with higher than average energy consumption or lower than average energy efficiency. These are both in the form of energy efficient appliances, but also changed consumption habits to lower energy need and raise energy efficiency.

Energy efficiency does have a dilemma, highlighted for example by the research group Assist2Gether that recognizes one of the risks for energy poverty in Finland the strong effort to regulate and enforce high energy efficiency. This can cause additional energy related costs to households that might already be in the situation with limited finances (Assist2Gether 2018, 15). To conclude, high energy efficiency including smart consumption, other new smart solutions and high insulation levels of houses lowers the energy need and thus should translate into lowered energy poverty – but it is a two sided sword where it can at the same time cause energy poverty when enforced on the customers by regulation.

Based on previous research on the impact of energy efficiency and housing types on energy poverty, we identify two hypotheses for the quantitative research in chapter 5.

H06: Risk of energy poverty is high amongst detached homeowners.

H07: Risk of energy poverty is high in amongst homeowners of older homes.

4.1.5. Inability to fight energy poverty

As a last indicator, not directly causing energy poverty, but setting individuals who already suffer from it at a higher risk of not being able to recover. A study conducted by Gouveia et. al recognize that the question of energy poverty is not merely one of the current states of the individual, but also the ability of the individual to fight energy poverty (Gouveia et. al 2019, 190). Gouveia et. al find out in their research that unemployment, dwelling ownership, education level, monthly income, age of the

population, and buildings state of conservation impact an individuals' or households' capability to fight energy poverty.

Homes with low conservation levels – usually the older buildings – need reparations to be more energy efficient. For reparations, individuals will need money. The socio-economic status, employment, age and education level will have a strong impact on the individual's capability of fighting poverty (Gouveia et. al 2019, 197)

According to the research, the highest risk is within households living in municipalities with decreasing population, due to the loss of the home value (Runsten, Berninger, Heljo, Sorvali, Kasanen, Vihola & Uotila 2015).

Based on the research regarding individuals and households' ability to fight energy poverty, the following two hypotheses are identified.

H08: Households with arrears on their energy bills are more likely suffering from energy poverty

H09: Energy poverty is challenging for households with low ability to fight it.

The final two together with the before-mentioned seven hypotheses will be quantified and researched in chapter 5 in order to confirm the hypotheses and will be concluded by answering the research questions.

4.1.6. Summary of energy poverty factors

The abovementioned factors and correlations found in energy poverty can be divided into two main categories that are essential for this research. The factors, shown in table 1. below are ones that are caused by societal structural causes and are not impacted by direct policy measures and ones that can be impacted with direct policy measures. The division is not as clear for every factor, which will be discussed later in the research together with policy implications of energy poverty in Finland.

Table 1 The division of energy poverty factors into two main categories

Impact through direct policy efforts	Issues less sensitive to direct policy efforts
Socio-economic status:	**Living of individuals:**
Poverty and deprivation	Energy consumption levels/energy efficiency
Unemployment	Living distances
Income of students	Sources of energy and heating types
Income of senior citizens	Age of housing
Cost of goods:	Type of housing
Energy prices	
Schooling & welfare:	
Inability to fight energy poverty	

The division into categories in table 1 above has been made with the assumptions that there are factors that can directly be impacted through policy efforts and factors that cannot be impacted by policy or at least are limited by their nature.

In the view of social policy of a welfare state, policy efforts are in place to ensure equal rights through social justice, to ensure social balance and removal of inequalities, to ensure social peace through social structure, to make social integration possible and finally to ensure social democracy with equal rights and freedoms for individuals. A welfare state can be defined as a state that aims to provide individuals with equality, equal opportunity, basic needs, freedom and rights (Aravacik 2018.)

With this definition, social policy efforts can directly impact socio-economic issues, cost of goods by taxation and support schemes, and the capability of individuals to be part of the society through schooling and other societal structures.

The factors that social policy cannot directly impact but can to some extent indirectly steer individuals in are ones where individuals are exersizing their free will. These include the type of housing they live in, the location they live in, and the type and amount of energy they decide to use in their homes.

In the following chapter we will research the European and national policy efforts in place to impact the factors recognized above.

4.2. Previous research on policy implications of energy poverty at the EU level

Direct policy work in the form of directives and guidelines is lacking on the European level, but research and push to recognize the issue.

The Explanatory value for EU is significant and touches two important sectors of EU policy - Energy and social welfare. In this chapter we will review the main historical development in EU discussion regarding energy poverty.

Energy has been at the core of the treaties leading to the European Union. The European Coal and Steel community and Atomic Energy treaties were organized to unify and have a central authority for European decision making between the economic powers of the time (Bouzarovski 2018, 45).

Energy policy has been in the center of the European Union legislative focus already since the treaty of Lisbon in the year 2007 (Braun 2012, 14). One of the core visions is the European Energy Union, including an internal energy market and harmonized national energy policies. Energy in the form of "*a European green deal*" is also one of the six European Commission priorities for 2019-2024, where the European Commission is planning for the Europe to strive to become the first climate-neutral continent (European Commission 2020c).

But how is energy poverty considered in the Union, and what are the policy implications?

4.2.1. Energy as a human right

Although challenged in academical research and discussions, one European theory or ideology is that access to energy should be a human right. This ideology is supported by the European Commission's Group of Ethics in Science and New Technologies (EGE). EGE interprets the 1966 Covenants on economic, social and cultural rights together with the Charter of Fundamental Rights of the EU that to the rights of EU citizens – and humans in general – include adequate standard of living and access to services of general economic interest (European Commission 2013a).

According to EGE and other advocacy groups, energy poverty is partly a human rights issue, where the responsibility of the EU and the member states is to provide all citizens with access to safe, affordable and sustainable energy. These groups argue that energy poverty requires strong political approach and intervention. Some of the suggested political approaches would be to prohibit disconnections and regulating electricity prices – which have effectively been implemented especially in the southern European countries. This does not come without counterarguments and contradiction from other EU aspirations, one of them being the vision of a market driven model (Bouzarovski 2018, 48.) Some of these suggestions have recently been implemented and suggested in more recent legislative efforts, such as the Clean Energy for All Europeans package. But at the same time, the same packages are removing some of the already existing alleviations, such as the regulated prices, and replacing them with programs and alleviations specifically designed for vulnerable consumers.

4.2.2. The Third Energy Package, 2009

The third energy package was the European Commission's aim to harmonize and build structure for the European Energy Union, including the internal energy markets for electricity and gas. The package included two directives and three regulations that altogether cover five areas; unbundling of the energy supply and power generation from the natural monopoly of transmission networks, appointing of national independent energy regulators, the establishment of a central regulatory supervisor ACER, cross-border cooperation, and the strive towards open and fair retail markets (European Commission, 2020d)

In both directives, energy poverty is recognized as a growing problem amongst vulnerable customers:

> *"Each Member State shall define the concept of vulnerable customers which may refer to energy poverty and, inter alia, to the prohibition of disconnection of gas to such customers in critical times."*
>
> (Official Journal of the European Union 2009, 211)

The actions taken by member states in implementing the directives to recognize and protect vulnerable customers include a combination of economic and non-economic measures. In a 2013 research made by European Council the measures recognized were special prices for vulnerable consumers, consultancy given to vulnerable customers on finding the best retail tariffs, support allowances for energy-related payments, support funding for energy efficiency and indirect economic support in the form of social security benefits (Bouzarovski 2018, 53). One more measure was recognized by a study conducted by the Council of European Energy Regulators (CEER 2012) where member states appoint "*suppliers of last resort*"; Obligating specific energy retailers with the public service responsibility to supply vulnerable customers with energy, supported by social tariffs and the government.

4.2.3. Europe 2020-strategy

In the year 2010 the European Union set in place a 10-year strategy called "Europe 2020" with goals and key objectives to be reached by 2020. The headline targets included objectives for employment, research and development, education, poverty and social exclusion, and climate change and energy (European Commission, 2010). In the Europe 2020 strategy, energy efficiency was mainly seen as a short- and long-term ambition to fight climate change. Thus, the goals set to be reached by the year 2020 for energy efficiency were placed with the environment in mind, often missing the mention of energy poverty, except in one location (see Directive 2010/31/EU) energy efficiency efforts in the fight against climate change were seen having a positive impact also in alleviating energy poverty (Bouzarovski 2018, 54).

This notion was later challenged in a study conducted by the International Energy Agency "IEA", debating that the assumed positive impact of energy efficiency on vulnerable customers would be much lower in short-term, and could even have the opposite negative impact. The IEA suggested that on the short-term, benefiting of higher levels of energy efficiency would most likely be the society and potentially the environment. IEA saw that strong energy efficiency efforts could actually risk vulnerable customers suffering in the short-term due to higher investment needs and raised costs (Heffner, G., & Campbell, N. 2011.) On the long-term, the impact of energy poverty on vulnerable customers could be more positive.

The same challenge has also been recognized when assessing energy poverty in Finland. Energy efficiency policies and efforts may present a potential risk of vulnerable customers facing challenges, when enforcing the cost to end-users. For vulnerable customers, energy efficiency and the environment are secondary priorities, after the need for affordable energy (Gullman 2019, 39.)

4.2.4. European social policy

Even though the main efforts to fight, regulate and define energy poverty in the EU has been through energy sector related packages and channels, it is also recognized in various EU social policy forums. For example, the European Commission recognizes access to energy as a crucial part in the fight to eradicate extreme poverty:

> *"to lift people out of poverty will require access to energy since achieving the goal of eradicating extreme poverty by 2015 cannot be met unless substantial progress is made on improving access"*
>
> (European Commission 2010, 17)

The European Commission has set up a working group for recognizing vulnerable customers and defining the social policy efforts to fight poverty in Europe. In a report published by the working group in 2013, the working group recognizes that vulnerable customers need support with energy related challenges, especially in the cold and challenging times of the year (European commission, 2013b.)

In the light of the post-2008 financial crisis and economic recession, the European Commission conducted a study on household expenditure, to recognize where the challenges and poverty risks were. The study recognized that energy prices and household energy expenditure had been rising, causing a higher share of energy poverty or risk of it across Europe. It was recognized that the efforts suggested in the third energy package five years earlier were even more timely, since the combination of rising costs with already being a vulnerable customer has increased the energy poverty challenges (European Commission 2014, 14.)

Later studies have recognized the same risk in the Nordics. Bouzarovski & Herrero (2017, 82) recognize through their comparative research the Nordic countries as part of the relatively steady group of low energy poverty countries. Bouzarovski and Herrero warn of the energy poverty risk that has been looming after the economic crisis, with energy prices growing faster than inflation rates in the Nordic countries.

The European Economic and Social Committee (EESC) concludes that even though energy and energy poverty are important factors in EU social policy, they are issues for the energy sector to assess through energy policy. There have not been any directives or social policy guidelines directed for energy poverty, even though it is widely recognized. (European Economic and Social Committee 2011, 44–56)

4.2.5. Clean energy for all Europeans package, 2018

Most likely as a result of the previously mentioned European wide policy efforts and strong indications that there is something to be done regarding energy poverty, the "Clean Energy for All Europeans"-package (CEP) brings more light and emphasis on the fight against energy poverty (European Commission, 2020e).

The CEP was published as a proposal by the European Commission in 2016 and was entered into force by the agreement of the European Council and the European Parliament in 2019. It includes eight legislative acts and is a comprehensive update to all energy related policy, with the aim of helping the entire EU benefit from the energy transition, moving towards achieving carbon neutrality by 2050 (European Commission, 2020e.)

Energy poverty and vulnerable customers are mentioned in the CEP multiple times. One of the locations where member states are directed to act is in the EU directive 2019/944 of the European Parliament and of the Council on common rules for the internal market for electricity and amending Directive 2012/27/EU.

In article 28, Vulnerable customers are defined in the following manner (Official Journal of the European Union 2019):

> *"Member States shall take appropriate measures to protect customers and shall ensure, in particular, that there are adequate safeguards to protect vulnerable customers. In this context, each Member State shall define the concept of vulnerable customers which may refer to energy poverty and, inter alia, to the prohibition of disconnection of electricity to such customers in critical times..."*

In article 29, Energy poverty and the responsibility of member states is defined as follows:

> *" When assessing the number of households in energy poverty pursuant to point (d) of Article 3(3) of Regulation (EU) 2018/1999, Member States shall establish and publish a set of criteria, which may include low income, high expenditure of disposable income on energy and poor energy efficiency.*
>
> *The Commission shall provide guidance on the definition of 'significant number of households in energy poverty' in this context and in the context of Article 5(5), starting from the premise that any proportion of households in energy poverty can be considered to be significant."*
>
> (Official Journal of the European Union 2019)

Energy poverty is also referred to in the EU regulation 2018/1999 of the European Parliament and of the Council, published 11 December 2018, on the Governance of the Energy Union and Climate Action.

In article 3, member states are regulated to measure and assess the number of households living in energy poverty. According to the regulation this should be done in each member state's integrated national energy and climate plans:

> *"With regard to their integrated national energy and climate plans, Member States shall…assess the number of households in energy poverty taking into account the necessary domestic energy services needed to guarantee basic standards of living in the relevant national context, existing social policy and other relevant policies, as well as indicative Commission guidance on relevant indicators for energy poverty."*
>
> (Official Journal of the European Union 2018)

Member states that are recognized to have significant levels of energy poverty are regulated in Article 24 to include in its integrated national energy and climate progress reports a which policy measures it intends to use in order to alleviate energy poverty:

> *" …the Member State concerned shall include in its integrated national energy and climate progress report:*
>
> *(a) information on progress towards the national indicative objective to reduce the number of households in energy poverty; and 21.12.2018 EN Official Journal of the European Union L 328/29*
>
> *(b) quantitative information on the number of households in energy poverty, and, where available, information on policies and measures addressing energy poverty."*
>
> (Official Journal of the European Union 2018)

In addition, vulnerable customers and alleviation to energy poverty are mentioned regarding energy efficiency efforts and how locally produced renewable energy and energy cooperatives may have a positive impact (Official Journal of the European Union 2018). Also, Bouzarovski reflects how national energy transition efforts, leading to locally produced energy will most likely have a positive impact to energy poverty, since not being so dependent by international events or politics (Bouzarovski 2018, 23).

4.2.6. Energy poverty observatory EPOV

One of the outcomes of the CEP has been the European Commission observatory for Energy Poverty. It has been given the task of being the main European driver for supranational and national research of energy poverty. EPOV was founded in 2018 as a consortium of 13 organizations, including universities, think tanks, and the business sector – supervised by the European Commission. The observatory has been gathering data and researching main causes of energy poverty and the depth of them in all the European Union member states (European Commission 2020b.)

EPOV has identified four primary indicators for energy poverty in Europe. The first EPOV primary indicator is the share of households of the population having arrears on their energy supplier bill (European Commission 2020f). This indicator, pictured in figure 1 below, examines the probability of households experiencing some level of energy poverty through challenges in being able to pay for their energy on time.

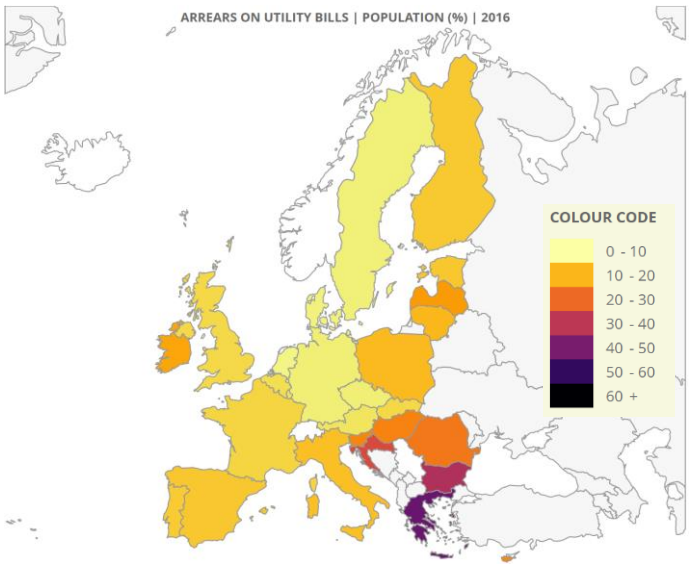

Figure 1 Color coded map, describing the percentage of the population with arrears on utility bills (European Commission 2020f).

The second EPOV primary indicator is low absolute energy expenditure, pictured in figure 2 below. This is a more hidden form of energy poverty and is measured by comparing a household's energy consumption with a national median. According to

EPOV, households are with high probability experiencing energy poverty when their energy consumption is lower than half of the national median, or abnormally low. This can indicate that the household is consuming energy, but not for adequate amounts of heat, cooling or other purposes (European Commission 2020f.)

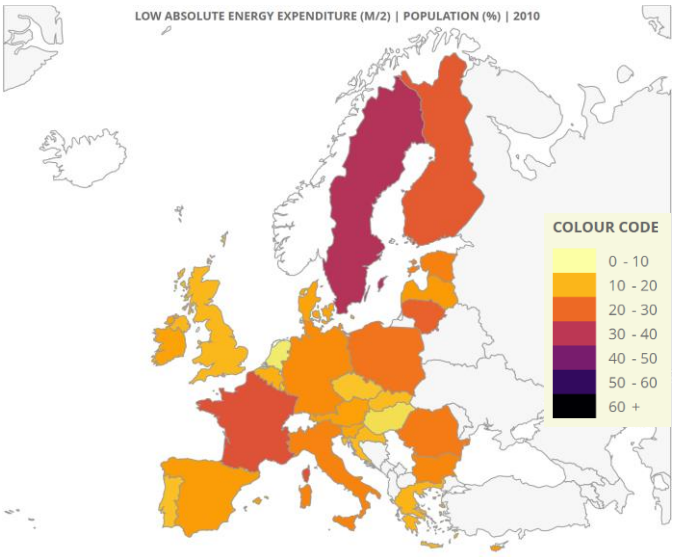

Figure 2 Color coded map, describing the percentage of the population with absolute energy expenditure less than half of the national median (European Commission 2020f).

The third EPOV primary indicator is high share of energy expenditure in income, pictured in figure 3 below. Households where a high share of income goes to energy expenditure are most likely having challenges with their expenditure. EPOV is considering with a high likelihood that households with a share of energy expenditure more than twice the national median annual income are suffering from energy poverty, or some form of deprivation (European Commission 2020f.)

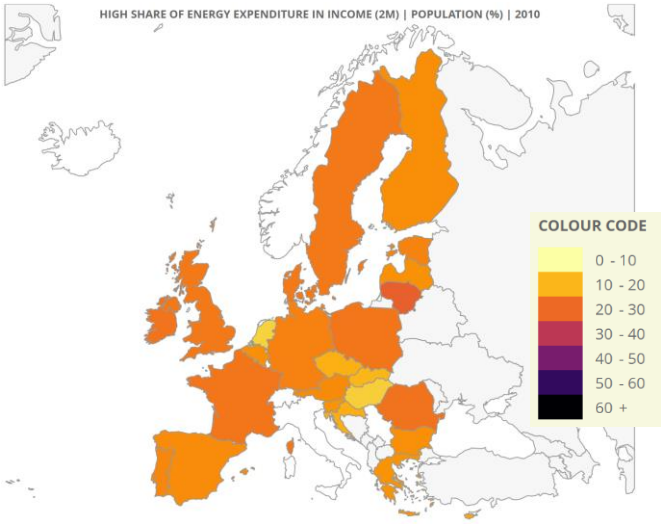

Figure 3 Color coded map, describing the percentage of the population with absolute energy expenditure more than twice the national median annual income (European Commission 2020f).

The fourth and final EPOV primary indicator is the inability to keep the home adequately warm. This indicator is challenging to quantify and measure outside of a home, since it is challenging to estimate what the standard level of adequacy is. EPOV has gathered data through a qualitative questionnaire with the research question: "does your household afford to keep the home adequately warm?". The results of the questionnaire are pictured in figure 4 below (European Commission 2020f.)

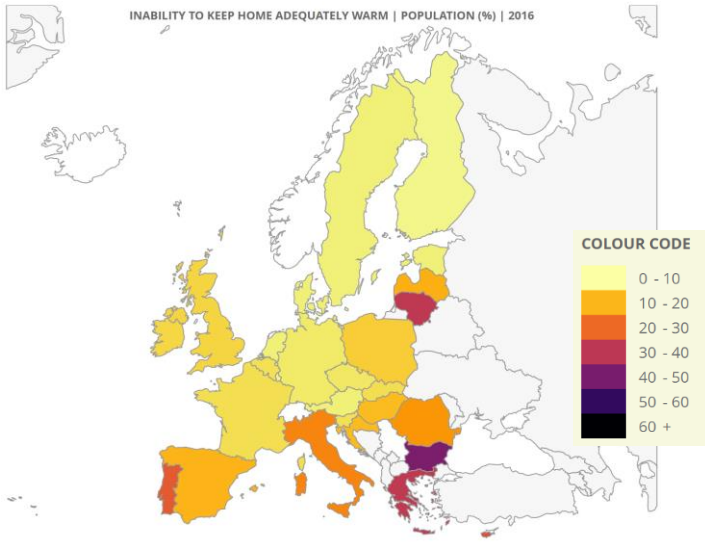

Figure 4 Color coded map. Describing the percentage of the population not able to keep their home adequately warm (European Commission 2020f).

In addition to these primary indicators, the EPOV has secondary indicators that are relevant in the context of energy poverty. These indicators are not direct indicators of energy poverty, but rather indicators that can be used as tools for understanding the levels and causes of energy poverty in each member state. The EPOV secondary indicators include for example data on the development of energy prices and data on different housing types of each member state (European Commission 2020f).

4.3. National energy poverty efforts in Europe

As mentioned above, the European Council conducted a study after the third energy package recognized different direct and indirect measures to measure, alleviate and obliterate energy poverty (Bouzarovski 2018, 53).

Bulgaria is one of the EU member-states where energy poverty has been measured and direct policy efforts have been taken. Bulgaria is a country with high measured levels of energy poverty is Bulgaria, in fact the highest in Europe (Bouzarovski 2012 and European Commission 2020f).

In 2009 an estimate of 64,5% of the citizens in Bulgaria were not able to keep their homes adequately warm and 34% of the population reported having arrears on their energy bills. Altogether in 2009 an estimate of 360 000 households of a total 2,9 million households were getting social support in various forms for their energy needs (Bouzarovski 2012, 80.) A research made in 2012 showed that altogether six institutions and ministries were working together in topics of energy poverty and vulnerable customers. Together they have set up three welfare programs for helping vulnerable customers with their energy needs. First, all households that are recognized getting minimum salary get welfare support to keep their homes adequately warm. Second, households that are recognized to have a lower than average energy consumption get a lower energy tariff. Third and final, households that are not connected to the more affordable district heating during wintertime get a lower electricity tariff in night-time during the winter, to ensure that heating and consumption of electricity is more affordable (Bouzarovski 2012, 80–81.)

An opposite extreme to Bulgaria of policy efforts and energy poverty levels is Finland, where the energy poverty levels are estimated at below 5% of the population. The non-governmental EU funded research group Assist2Gether suggests that Finland belongs to a relatively well-off group of EU member states, with the difference that there are no national initiatives to directly fight the phenomenon (Assist2Gether 2018, 13). In Finland, energy poverty has not been recognized or defined in any policy documents (Gullman 2019, 22) and the efforts taken in Finland to fight energy poverty have been mainly just to recognize the phenomenon for better understanding its significance (Oja, Vaahtera, Vehviläinen, Ahvenharju & Hakala 2013, 5).

The research in Finland consists of the Ministry of the Environment report on energy poverty and the energy costs of households, conducted and published in 2013 as a response to the requirements of the third energy package and in the light of the post-2008 financial crisis and economic recession (Oja, Vaahtera, Vehviläinen, Ahvenharju & Hakala 2013). In the year 2015 the Ministry of the Environment published a follow-up report, specifying and assessing the social and welfare support schemes that are expected to alleviate energy poverty in Finland. The report was conducted as an assessment of energy poverty amongst low-income owner-occupied dwellings, to understand the share of vulnerable population vulnerable in need of renovations to upgrade household heating sources. The report also updated an assessment of household energy costs (Runsten, Berninger, Heljo, Sorvali, Kasanen, Vihola & Uotila 2015.)

The previous national emphasis has been on the existing welfare support schemes for vulnerable members of the society with the belief that they are enough. The welfare support schemes for vulnerable individuals in Finland include (Gullman 2019, 5–10):

1. Social security schemes
    a. General housing allowance
    b. Housing allowance for elderly
    c. Income support
2. Repair allowance for housing for the elderly and disabled
3. Social lending
4. Church deaconess fund
5. Guarantee fund

As also CEER recognized, many member states have appointed energy retailers as "*suppliers of last resort*" (CEER, 2012). This is also what has been placed in Finland as a safety-net for vulnerable customers that are not able to pay for their energy costs. All the above-mentioned support schemes have been built with a general purpose of alleviating the challenges of vulnerable members of the society. It is believed that these schemes are already responding to the issue of energy poverty (Gullman 2019, 5).

It can be argued that the efforts in Finland to recognize and define the issue have been low (Gullman 2018, 38). The research group Assist2Gether does also raise the concern that even though Finland does belong to the fairly well-off part of EU member states, energy poverty can potentially develop negatively due to rising housing costs, additional energy related costs due to smart energy efforts and a high lack of awareness of energy poverty in the society and by the regulators (Assist2Gether 2018, 15).

Other European countries fall in-between these two extreme examples in the EU. It is expected that through the directives and regulations in the CEP and the tracking and measuring efforts done by the EPOV, there will be more harmonized and defined measures to fight energy poverty across the EU member-states (Official Journal of the European Union 2019).

4.4. Summary of policy efforts and implications

The abovementioned policy implications are directly or indirectly affecting energy poverty. The main policy efforts, but not all, are categorized below in table 2.

Most policy efforts are directly impacting one ore multiple factors of energy poverty whereas many of the EU efforts to alleviate through recognizing and quantifying the issue are not directly impacting any of the factors behind energy poverty.

Table 2 Policy implications and efforts categorized

	Impact through direct policy efforts	**Issues less sensitive to direct policy efforts**
Socio-economic status Poverty and deprivation Unemployment Income of students Income of senior citizens	Special prices for vulnerable customers support allowances for energy related payments social security support Suppliers of last resort	European social policy efforts
Cost of goods: Energy prices	support allowances for energy related payments Taxation	Energy as a human right Energy consultancy
Schooling & welfare: Inability to fight energy poverty	social security support	
Living of individuals: Energy consumption levels/energy efficiency Living distances Sources of energy and heating types Age of housing Type of housing	Energy efficiency support funding	Energy efficiency of Europe Renewable energy efforts of Europe Efforts on locally produced energy
Other:		Third energy package, defining energy poverty CEP-package, measuring and assessing energy poverty EPOV

The policy implications in table 2 are divided according to social policy efforts that impact the previously identified factors directly or indirectly.

5. Recognizing energy poverty in Finland

Based on the systematic qualitative secondary analysis, presented in chapter 4, the following causes and hypotheses were identified for energy poverty. The hypotheses will be used and discussed for the quantitative section of this research.

H01: Risk of energy poverty is high among the vulnerable or low-income citizens. As found by previous research, vulnerable consumers and citizens with a above poverty level but low-income are under a high risk of energy poverty. The regional significance of this hypothesis can be quantified and measured with the Statistics Finland data on socio-economic status and income levels of Finnish citizens.

H02: Risk of energy poverty is high amongst the elderly. As recognized by previous research, out of vulnerable customers especially senior citizens have a high risk of suffering from energy poverty with a limited capability to fight it. The regional significance of this hypothesis will be quantified with the Statistics Finland data on population age.

H03**:** the risk of energy poverty is high in households living in the sparsely populated areas. Previous research found that sparsely populated areas with long distances of travel and usually higher than average energy costs can cause energy poverty amongst the population. Previous research also concluded that these households have limited capability of fighting energy poverty, due to these regions losing value on real estate. The regional significance of this hypothesis in Finland will be quantified by Statistics Finland data on population density.

H04: Risk of energy poverty is high in homes with oil heating. Previous research on energy poverty in Finland made the assumptions that detached housing using oil heating has a higher than average risk of suffering from energy poverty. Since this is already recognized as an issue in Finland, the regional significance will be measured using Statistics Finland data on heating types in residential housing.

H05: The comparison of energy price development with the development of income levels may show the most vulnerable socio-economic groups. In addition, it will tell if the price development is indicating that the issue is growing. Previous research flagged that even though Finland might be a well-off country today, the development of income levels

compared with the development of energy cost might be causing negative development on the issue. The regional significance of this hypothesis will be researched using Statistics Finland data on historical income levels, or their development, together with the historical development of the cost of consumer energy.

H06: Risk of energy poverty is high amongst detached homeowners. Previous researched indicated that energy poverty is more common amongst detached homeowners than other types of living. Statistics Finland data on housing type will be used to discuss the regional significance of this issue.

H07: Risk of energy poverty is high in amongst homeowners of older homes. Due to more likely suffering from low energy efficiency and high cost housing faults, the share of population living in older homes are more likely to suffer from energy efficiency according to previous research. The regional significance will be researched using Statistics Finland data on the age and type of housing in Finland.

H08: Households with arrears on their energy bills are more likely suffering from energy poverty. Previous research, together with estimates from the European Commission Energy Poverty Observatory find a correlation between arrears on energy bills and energy poverty. Most likely the households that are not able to pay their energy bills are suffering from energy poverty in some form. This hypothesis can be expected to have high significance on national and regional level in Finland, but unfortunately there is no data that could be used to research it further.

H09: Energy poverty is challenging for households with low ability to fight it. Finally, the households that suffer from energy poverty with low or no possibility of fighting it due living conditions, socio-economic status, living arrangements or similar are part of the high-risk group of the population what comes to energy poverty. This hypothesis will be researched as a summary of the quantitative research of the other eight hypothesis. Each region is given a point for how well or poorly they measure in each of the hypothesis, based on Statistics Finland data. The region with the highest points is the most likely to suffer from energy poverty and has the highest share of individuals not capable of fighting energy poverty without social support, when suffering from it.

5.1. Division of Finland into regions

Finland is a sparsely populated country with long distances. The country has historically been divided into six counties, as described in figure 5 below. The counties were (1) Uusimaa, (2) Länsi-Suomi, (3) Itä-Suomi (4) Pohjois-Suomi (5) Lappi and (6) Ahvenanmaa. The county structure was discontinued in 2009 but is still valid when researching historical regional data (Statistics Finland 2020a).

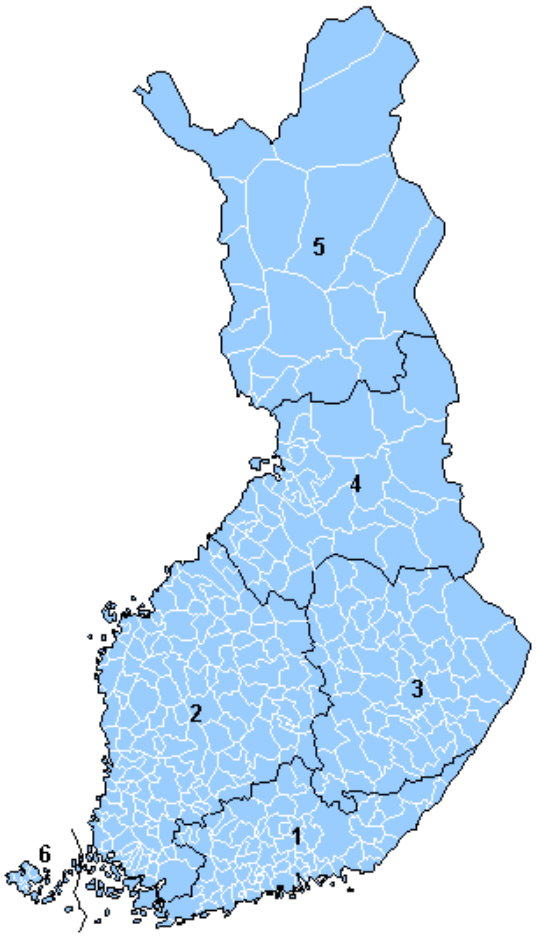

Figure 5 Former counties of Finland (Statistics Finland 2020a).

Today, Finland is divided into 19 provinces which are Uusimaa, Varsinais-Suomi, Satakunta, Häme, Pirkanmaa, Päijät-Häme, Kymenlaakso, Etelä-Karjala, Etelä-Savo, Pohjois-Savo, Pohjois-Karjala, Keski-Suomi, Etelä-Pohjanmaa, Pohjanmaa, Keski-Pohjanmaa, Pohjois-Pohjanmaa, Kainuu, Lappi and Ahvenanmaa (Regional council of Southwest Finland 2020). The division into provinces is pictured below in figure 6 below.

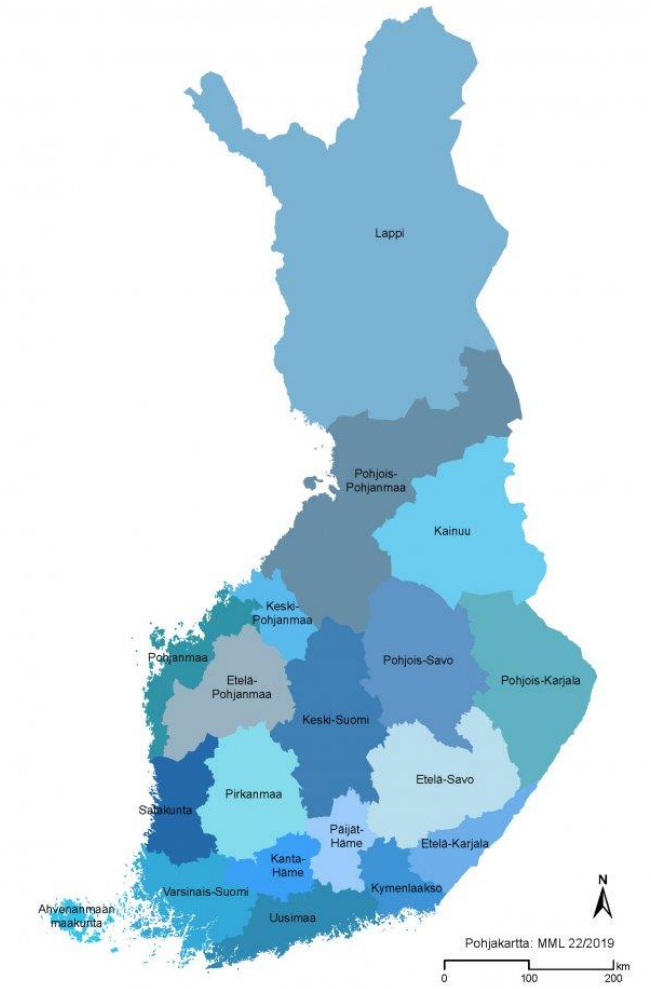

Figure 6 The division of Finland into 19 provinces. (Regional council of Southwest Finland, 2020).

In the aim of recognizing and understanding the regions with high risk for energy poverty, both regional systems will be used.

5.2. Consumption of energy in Finland

Finland is a country of four seasons with houses that are generally well built to withstand the changing outdoors. Still, most of the domestic energy consumption in Finland is for heating *and cooling* as pictured in figure 7 below.

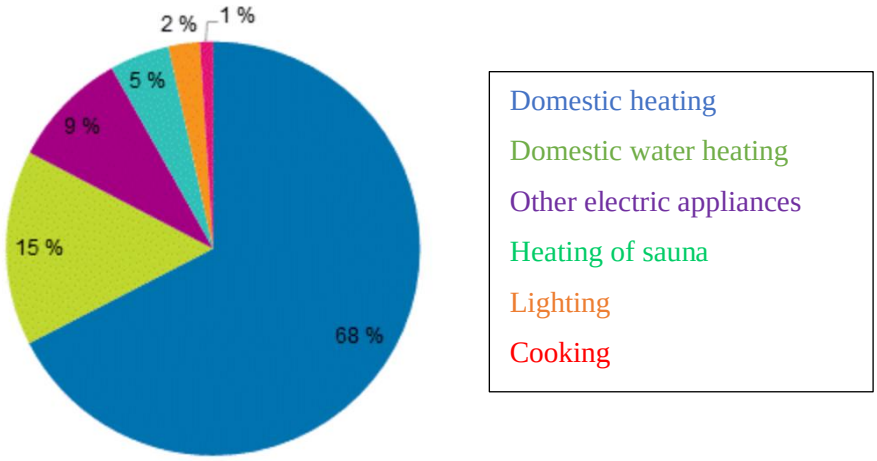

Figure 7 Energy consumption of living in 2018, divided by consumption purpose (Statistics Finland 2020b).

Statistics Finland does not include in the measurement of domestic energy consumption the share of energy needs in transportation, which is an essential part of energy poverty in a country with long average distances and sparse population. This will be analysed and discussed later in this study.

As in the other Nordic countries, but an exception to other European countries, domestic energy use of gas is non-existing. As pictured below in figure 8, the energy sources with the highest utilization in Finland are electricity, district heating and timber. Previous research has indicated that the share of population heating with oil, wood and electricity would be under the highest risk of energy poverty, whereas district heating is the lowest risk (Ympäristöministeriö 2015). Thus, district heating will not be considered in this analysis.

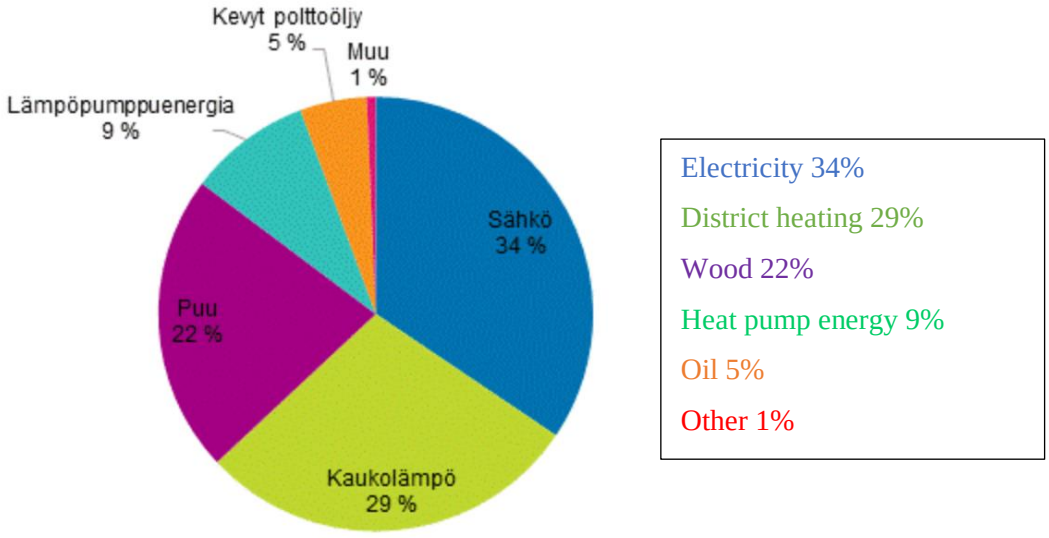

Figure 8 Domestic energy consumption in 2018, divided by source of energy (Statistics Finland 2020b).

5.3. Multidimensional quantitative analysis

In this section the different indicators will be studied based on already existing data, mainly from statistics Finland. In case the necessary data does not exist, the need and reason will be discussed.

H01: Risk of energy poverty is high among the vulnerable or low-income citizens

According to previous research vulnerable customers are under high risk of suffering from energy poverty. Previous study concludes that elderly, students, unemployed and citizens with an income less than 60% of national average should be considered as vulnerable.

In order to quantify and recognize the regionality of the issue, we combine data from two Statistics Finland sources and compare them together to find correlation. The analysis is a combination of Statistics Finland data from 2016 on average domestic energy costs in Finland (Statistics Finland 2020c) and Statistics Finland data of average income for the socio-economic groups from the same year (Statistics Finland 2020d). The comparison is done on province-level, since that is the level that Statistic Finland has gathered the average domestic energy costs in Finland. The results are visualized in figure 9 below.

The energy costs visualized include average household electricity, transmission fees and fuel costs such as gasoline. The data does not include the number of citizens with a 60%-below the average income level but include different socio-economic groups.

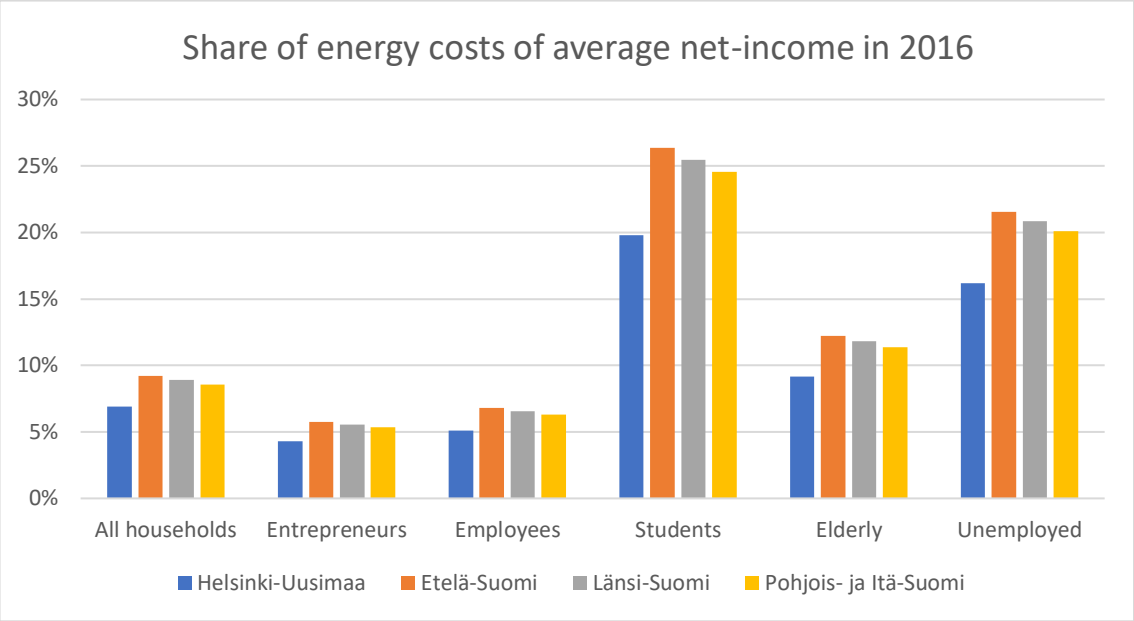

Figure 9 Energy costs compared with average net-income in 2016, divided into four counties.

The hypothesis states that the vulnerable socio-economical groups would have a risk of falling into energy poverty. With the definition of the Low-Income-High-Cost indicator, where households that spend more than 10% of their income on fuel are considered being in the risk of becoming energy poor, this hypothesis does show significance. Students, elderly and unemployed are all on average spending 10-26% of their net-income on energy and fuel, except for elderly in the Helsinki-Uusimaa county.

All the mentioned vulnerable groups already are under social- and welfare support schemes, but the share of energy costs of the income of these vulnerable households is high. With rising energy costs, or peaks in them, vulnerable individuals are under high risk of falling into energy poverty – or at least suffering from energy deprivation. Based on this comparison, students seem to be under the highest risk.

H02*: Risk of energy poverty is high amongst the elderly*

The socio-economic group of elderly are part of the vulnerable individuals already studied in the first hypothesis, but in this hypothesis a closer look will be taken. Based on previous research, elderly people have high risk to suffer from energy poverty for two reasons. First, they are considered vulnerable customers due to potentially having low income levels. Second, they are individuals with limited capacity to fight energy poverty.

Previous research in Finland has also shown that elderly people are vulnerable for energy poverty and when suffering from it, can quite possibly be impacted with much more serious consequences than the other vulnerable socio-economic groups (Gullman 2018, 23).

To recognize the regions with the highest share of elderly residents, thus the share with highest percentage of this vulnerable socio-economic group, we are using Statistics Finland data on the Age of the population, divided in counties (Statistics Finland 2020e). The results are visualized in table 3 below, dividing the population into three age groups:

- Share of under 15-year old's;
- Share of 15-64-year old's;
- Share of over 65-year old's.

All results are shown by county, in percentages of the total population. The counties with the highest share of over 65-year old's, the most vulnerable age group are highlighted in shades of orange to red.

Table 3 Share of over 65-year olds of the residents in counties and provinces.

		Share of under 15-year olds	Share of 15-64-year olds	Over 65-year olds
Pohjois-ja Itäsuomi		**15,1 %**	**59,7 %**	**25,2 %**
	Lappi	**15,1 %**	**60,3 %**	**24,6 %**
	Kainuu	**14,1 %**	**58,5 %**	**27,5 %**
	Pohjois-Pohjanmaa	**19,6 %**	**61,3 %**	**19,1 %**
	Etelä-Savo	**12,8 %**	**57,1 %**	**30,1 %**
	Pohjois-Karjala	**14,1 %**	**60,3 %**	**25,6 %**
	Pohjois-Savo	**14,8 %**	**60,7 %**	**24,5 %**
Länsi-Suomi		**16,4 %**	**60,2 %**	**23,4 %**
	Etelä-Pohjanmaa	**16,7 %**	**58,6 %**	**24,7 %**
	Keski-Pohjanmaa	**18,9 %**	**58,3 %**	**22,8 %**
	Keski-Suomi	**16,0 %**	**61,2 %**	**22,8 %**
	Pirkanmaa	**16,0 %**	**62,7 %**	**21,3 %**
	Pohjanmaa	**17,3 %**	**60,0 %**	**22,7 %**
	Satakunta	**14,8 %**	**58,6 %**	**26,6 %**
	Varsinais-Suomi	**15,0 %**	**62,1 %**	**22,9 %**
Etelä-Suomi		**14,4 %**	**59,5 %**	**26,2 %**
	Etelä-Karjala	**13,6 %**	**59,7 %**	**26,8 %**
	Kanta-Häme	**15,5 %**	**59,8 %**	**24,6 %**
	Kymenlaakso	**13,6 %**	**59,0 %**	**27,4 %**
	Päijät-Häme	**14,7 %**	**59,4 %**	**25,9 %**
Helsinki-Uusimaa		**16,6 %**	**66,0 %**	**17,4 %**
	Uusimaa	**16,6 %**	**66,0 %**	**17,4 %**
Finland in average		**15,5 %**	**60,2 %**	**24,3 %**

The results of this study do not validate the hypothesis that over 65-year old's in Finland would suffer from energy poverty. The significance was recognized in H01 by the fact that the average share of energy expenditure of the income of elderly people is high. This hypothesis recognizes that the vulnerable group, in the risk of suffering from energy poverty, exists with the highest share of the population according to The Statistics Finland in the county of Southern Finland. The province with the highest share of over 65-year old's is Etelä-Savo.

H03: Risk of energy poverty is high in households in the sparsely populated areas

The third hypothesis based on previous research is that people living in the sparsely populated areas would be under the higher risk of energy poverty. This is due to the expectation of long traveling distances, expected form of living being detached housing and the challenge of lowering property values (Oja et.al 2013, 28.)

Based on the Statistics Finland data we can identify which of the counties and provinces have the lowest population density (residents/km^2). The data will be found in the Statistic Finland database for population density (Statistics Finland 2020f). In addition, we can identify the counties and provinces with the highest share of people living in sparsely populated rural areas. The data has been divided into provinces and counties. Four factors are analyzed:

- Population density (total). The lower the density, the higher the risk;
- Percentage of people living in urban areas. The higher the share, the lower the risk;
- Percentage of people living in rural areas. The higher the share, the higher the risk;
- Percentage of people living in sparsely populated rural areas. The higher the share, the higher the risk.

The results are presented in table 4 below.

Table 4 Analysis of the population in counties and provinces of Finland (Statistics Finland). Dark green indicates the lowest ranked counties and dark orange the highest risk ranked counties of each category. Light colors show the lowest and the highest risk ranked provinces.

		Population density	Percentage of people living in urban areas	Percentage of people living in rural areas	Percentage of people living in sparsely populated rural areas
Pohjois-ja Itäsuomi		9,00	41,18	38,00	11,50
	Lappi	1,90	56,80	41,50	26,60
	Kainuu	3,60	45,20	53,70	29,40
	Pohjois-Pohjanmaa	11,20	57,30	41,90	8,70
	Etelä-Savo	10,10	45,30	53,60	22,60
	Pohjois-Karjala	9,10	47,50	51,40	15,20
	Pohjois-Savo	14,60	55,80	43,10	11,00
Länsi-Suomi		25,90	57,96	41,10	5,36
	Etelä-Pohjanmaa	14,10	31,00	68,40	3,40
	Keski-Pohjanmaa	13,60	56,30	43,00	10,60
	Keski-Suomi	16,50	53,10	45,90	15,90
	Pirkanmaa	40,90	73,30	25,50	1,30
	Pohjanmaa	23,30	57,20	42,10	2,20
	Satakunta	28,00	61,80	37,20	3,60
	Varsinais-Suomi	44,90	73,00	25,60	0,50
Etelä-Suomi		32,53	75,75	23,25	1,30
	Etelä-Karjala	24,20	72,90	26,20	2,90
	Kanta-Häme	33,00	74,40	24,50	0,20
	Kymenlaakso	33,70	78,00	21,10	0,90
	Päijät-Häme	39,20	77,70	21,20	1,20
Helsinki-Uusimaa		183,70	90,30	7,80	0,00
	Uusimaa	183,70	90,30	7,80	0,00

Based on the analysis of the Statistics Finland data, the county with the highest risk of energy poverty according to the hypothesis would be northern and eastern Finland. The provinces with the highest risk are Lapland, Kainuu and Northern-Karelia.

The research of this hypothesis does not prove that these regions would suffer from energy poverty, but rather shows the significance of the issue. The research shows where the risk is the highest, based on hypothesis from previous research. The research of actual correlation with energy poverty is not possible due to the lack of energy poverty or deprivation measurements in Finland.

H04: Risk of energy poverty is high in households with oil heating

According to previous research, the homes most likely in danger of energy poverty are ones heated with oil. It should be noted that oil heating is generally only used in detached housing in sparsely populated areas. Due to this, the correlation with H03 and H06 is most likely high (Oja et.al 2013, 28.)

In order to research the hypothesis, data from Statistics Finland on household types and their heating from 2018 will be used (Statistics Finland 2020i). The results are visualized below in table 5.

Table 5 Household's and the heating energy shares in Finland, divided by counties and provinces.

	Share of domestic buildings with heating source						
	District heating	Oil & gas	Electricity	Coal	Wood & peat	Ground heat	Other, unknown
Pohjois-ja Itäsuomi	**12 %**	**14 %**	**41 %**	**0 %**	**27 %**	**4 %**	**2 %**
Lappi	7 %	17 %	46 %	0 %	24 %	4 %	2 %
Kainuu	16 %	10 %	36 %	0 %	32 %	5 %	1 %
Pohjois-Pohjanmaa	16 %	16 %	40 %	0 %	22 %	4 %	2 %
Etelä-Savo	8 %	14 %	39 %	0 %	33 %	3 %	2 %
Pohjois-Karjala	8 %	11 %	45 %	0 %	30 %	3 %	2 %
Pohjois-Savo	15 %	12 %	39 %	0 %	28 %	3 %	2 %
Länsi-Suomi	**8 %**	**25 %**	**38 %**	**0 %**	**21 %**	**5 %**	**2 %**
Etelä-Pohjanmaa	8 %	24 %	33 %	0 %	30 %	3 %	1 %
Keski-Pohjanmaa	12 %	26 %	38 %	0 %	18 %	5 %	2 %
Keski-Suomi	9 %	20 %	38 %	0 %	27 %	4 %	2 %
Pirkanmaa	10 %	24 %	40 %	0 %	18 %	6 %	2 %
Pohjanmaa	8 %	29 %	32 %	0 %	21 %	8 %	2 %
Satakunta	5 %	28 %	42 %	1 %	21 %	2 %	2 %
Varsinais-Suomi	8 %	27 %	40 %	1 %	18 %	5 %	2 %
Etelä-Suomi	**12 %**	**23 %**	**41 %**	**1 %**	**19 %**	**3 %**	**1 %**
Etelä-Karjala	16 %	23 %	35 %	1 %	22 %	2 %	1 %
Kanta-Häme	7 %	20 %	47 %	1 %	19 %	4 %	2 %
Kymenlaakso	9 %	28 %	39 %	1 %	18 %	4 %	1 %
Päijät-Häme	17 %	19 %	40 %	0 %	18 %	3 %	1 %
Helsinki-Uusimaa	**20 %**	**20 %**	**44 %**	**1 %**	**7 %**	**6 %**	**2 %**
Uusimaa	20 %	20 %	44 %	1 %	7 %	6 %	2 %
Finland in average	**12 %**	**21 %**	**40 %**	**0 %**	**20 %**	**4 %**	**2 %**

In this analysis only oil heated homes are analyzed, since previous research has not indicated energy poverty risk amongst other domestic heating types. The data shows that oil and gas heating have the lowest share in the counties of Northern and Eastern Finland. The highest share, thus the highest energy poverty risk is in the county of Western Finland and in the Pohjanmaa-province.

The research of this hypothesis does not prove that these regions would suffer from energy poverty. The research shows where the risk is the highest, based on hypothesis from previous research. The research of actual correlation with energy poverty is not possible due to the lack of energy poverty or deprivation measurements in Finland.

H05: Development of energy prices compared with development of income levels

Bouzarovski and Herrero argue that one of the main negative drivers for energy poverty in the Nordics are the rising costs of energy with slowly or almost non-developing levels of income (2017, 78–81).

In order to research the hypothesis, the Statistics Finland data for the change in the price of gasoline, diesel and consumer electricity (Statistics Finland 2020g) will be compared with Statistics Finland data on the change in average household income (Statistics Finland 2020h). This hypothesis should be considered together with H01. In case H05 is confirmed, the situation for vulnerable customers studied in H01 is only worsening.

Figure 10 below has been made to visualize the results. Data on the development of prices, starting from the year 2000 and ending in the year 2016 has been included to study this hypothesis.

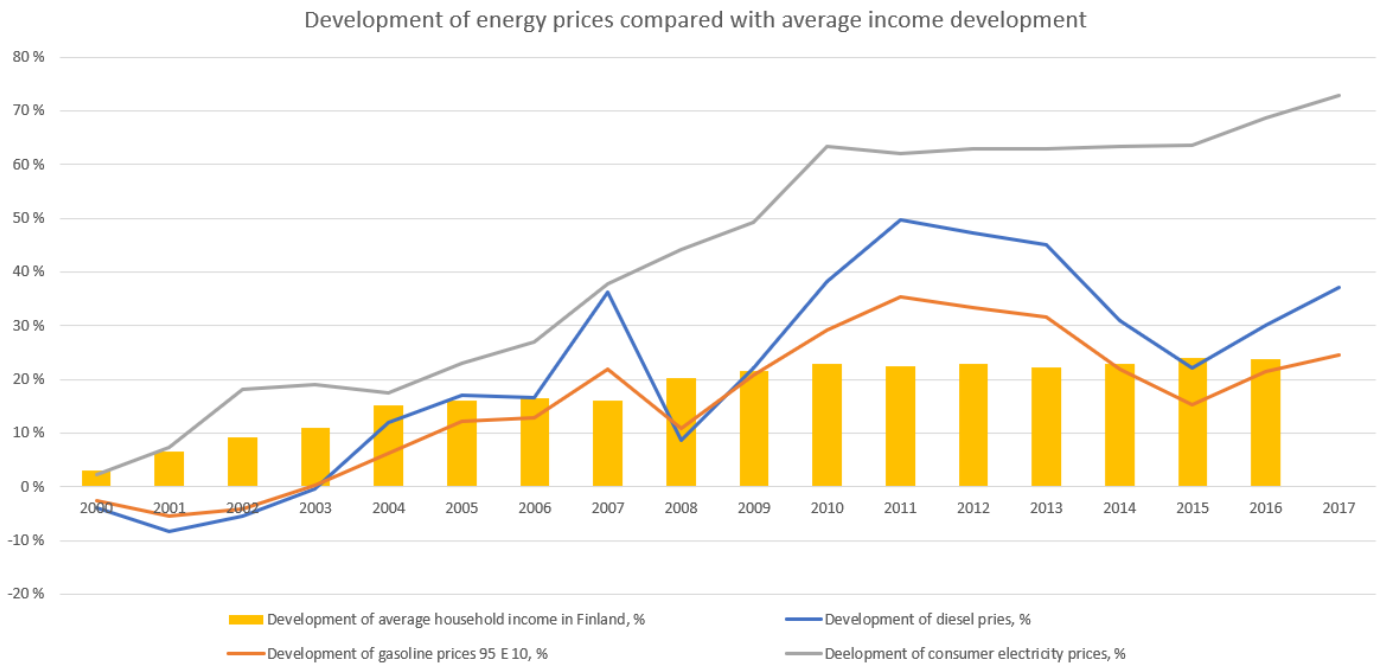

Figure 10 Change in the price of gasoline, diesel and consumer electricity compared with change in average household income. Starting point for the comparison is the year 2000.

The picture presents clearly how the energy prices have increased with up to 70% since the year 2000 in Finland. At the same time, the average income development has flattened out after the year 2008, with only a 20% growth per year from the year 2000.

To further research this hypothesis with the vulnerable socio-economic groups confirmed in H01, the comparison of energy price development will be made with income level development of these socio-economic groups.

As already recognized in the previous picture, the energy costs have been rising for the past 15 years. Meanwhile, as visualized in the figure 11 below the average income for the most vulnerable citizens that are students, unemployed and elderly have not followed the same development.

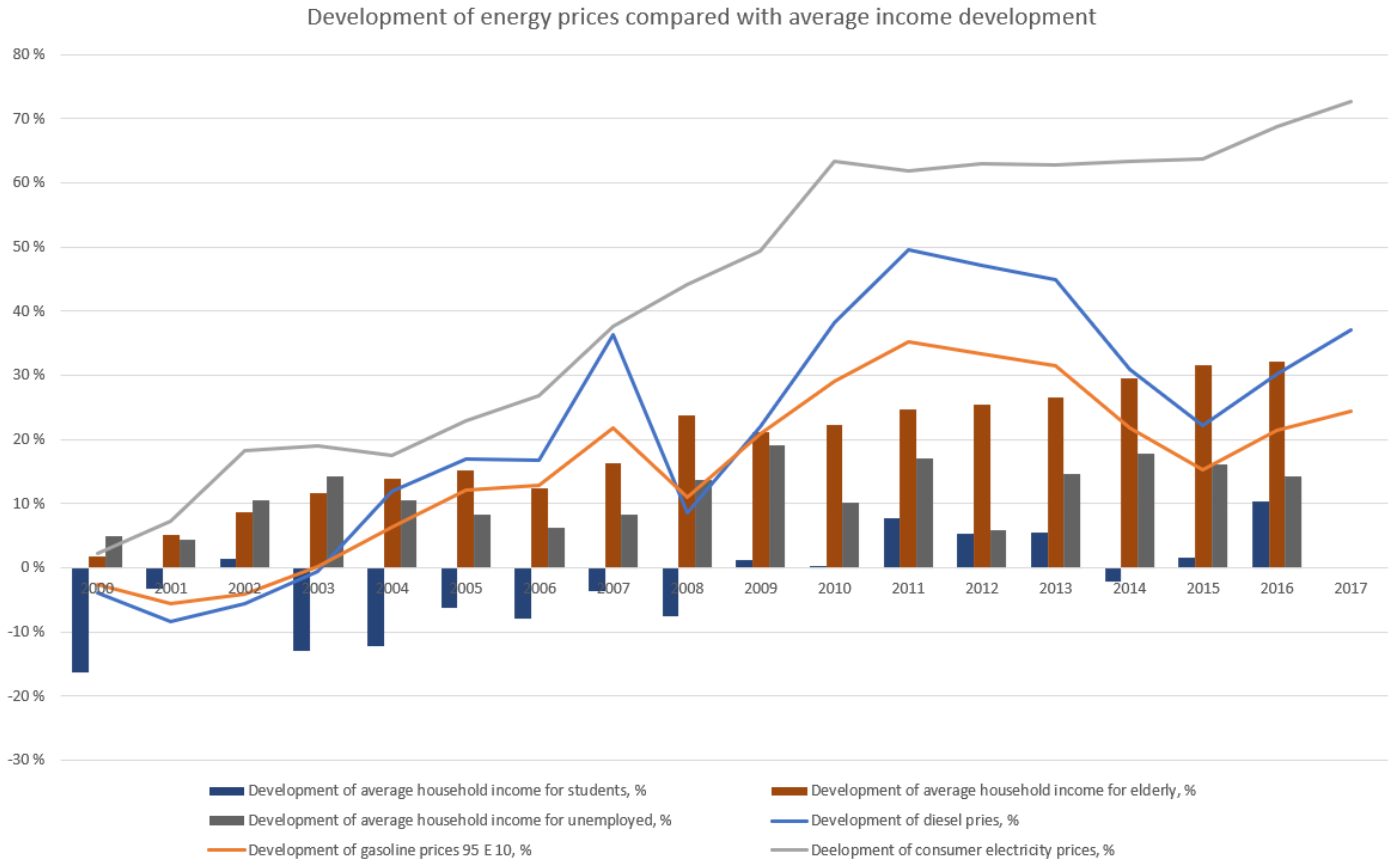

Figure 11 Comparison of the energy price development with the cumulative average income development of vulnerable citizens - students, unemployed and elderly.

Based on this it seems that Bouzarovski and Herrero (2017) were right with their hypothesis; the risk of energy poverty is growing even in the more well-off parts of Europe. The risk is especially high due to the lacking correlation of development in income levels of vulnerable customers and consumer energy prices.

H06: Risk of energy poverty is high amongst detached homeowners

According to previous research, energy poverty is the highest amongst detached homeowners. For studying the regionality of this hypothesis, data from Statistics Finland (2020i) on the number of detached homeowners in Finland in the year of 2018, divided by provinces, show that detached living is common in Finland, apart from the Helsinki-Uusimaa province.

The data visualized below in table 6, shows the highest number of detached homeowners reside in western Finland, provinces of Etelä-Pohjanmaa and Keski-Pohjanmaa.

Table 6 Share of detached homeowners in the year of 2018, divided by counties and provinces.

		Amount of homes	Amount of detached homes	Share of detached homes
Pohjois-ja Itäsuomi				
	Lappi	102842	51931	50 %
	Kainuu	42190	20598	49 %
	Pohjois-Pohjanmaa	211983	98205	46 %
	Etelä-Savo	88791	41885	47 %
	Pohjois-Karjala	95065	45568	48 %
	Pohjois-Savo	141146	58103	41 %
Länsi-Suomi				
	Etelä-Pohjanmaa	103215	61475	60 %
	Keski-Pohjanmaa	34541	20693	60 %
	Keski-Suomi	156338	63427	41 %
	Pirkanmaa	284803	97227	34 %
	Pohjanmaa	95933	49281	51 %
	Satakunta	127123	66377	52 %
	Varsinais-Suomi	268535	100130	37 %
Etelä-Suomi				
	Etelä-Karjala	75916	34788	46 %
	Kanta-Häme	97099	43645	45 %
	Kymenlaakso	100792	45216	45 %
	Päijät-Häme	116222	40881	35 %
Helsinki-Uusimaa				
	Uusimaa	878194	211635	24 %

According to the hypothesis and previous research, the detached homeowners have the highest risk of being energy poor. Thus, the provinces Etelä-Pohjanmaa and Keski-Pohjanmaa and the county of western Finland indicate the highest risk of suffering from energy poverty.

The research of this hypothesis does not prove that these regions would suffer from energy poverty. The research shows where the risk is the highest, based on hypothesis from previous research. The research of actual correlation with energy poverty is not possible due to the lack of energy poverty or deprivation measurements in Finland.

H07: Risk of energy poverty is high amongst homeowners of old homes

Previous research shows that in addition of living in detached housing, the age of the home raises the risk of being energy poor due to lower energy efficiency and higher possibility for housing faults. The heat-map in table 7 below shows the percentage of the age of housing in each province. The data used in the table comes from Statistics Finland data on buildings divided by housing type and age (Statistics Finland, 2020j).

Table 7 Share of the age of housing in provinces and counties.

		Age of housing								
		-1920	1921 - 1939	1940 - 1959	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1999	2000 - 2009	2010 -
Pohjois-ja Itäsuomi										
	Lappi	1 %	1 %	13 %	14 %	21 %	22 %	13 %	8 %	7 %
	Kainuu	1 %	1 %	13 %	14 %	27 %	23 %	12 %	6 %	3 %
	Pohjois-Pohjanmaa	2 %	1 %	9 %	10 %	18 %	19 %	14 %	15 %	12 %
	Etelä-Savo	3 %	3 %	14 %	12 %	21 %	24 %	12 %	6 %	4 %
	Pohjois-Karjala	2 %	3 %	13 %	10 %	22 %	22 %	11 %	8 %	9 %
	Pohjois-Savo	2 %	3 %	14 %	12 %	21 %	21 %	11 %	8 %	8 %
Länsi-Suomi										
	Etelä-Pohjanmaa	4 %	3 %	12 %	10 %	18 %	20 %	11 %	11 %	10 %
	Keski-Pohjanmaa	3 %	2 %	12 %	12 %	20 %	20 %	11 %	10 %	10 %
	Keski-Suomi	2 %	3 %	13 %	11 %	19 %	18 %	13 %	11 %	10 %
	Pirkanmaa	3 %	4 %	13 %	12 %	19 %	15 %	10 %	13 %	11 %
	Pohjanmaa	6 %	5 %	13 %	13 %	20 %	16 %	10 %	9 %	9 %
	Satakunta	5 %	5 %	16 %	13 %	24 %	15 %	9 %	8 %	5 %
	Varsinais-Suomi	5 %	5 %	13 %	13 %	21 %	15 %	12 %	9 %	8 %
Etelä-Suomi										
	Etelä-Karjala	2 %	4 %	15 %	13 %	22 %	17 %	12 %	9 %	6 %
	Kanta-Häme	4 %	4 %	15 %	12 %	21 %	17 %	10 %	10 %	7 %
	Kymenlaakso	4 %	6 %	18 %	14 %	22 %	16 %	10 %	7 %	4 %
	Päijät-Häme	2 %	3 %	14 %	15 %	22 %	16 %	11 %	9 %	8 %
Helsinki-Uusimaa										
	Uusimaa	3 %	7 %	10 %	12 %	17 %	14 %	12 %	12 %	13 %
Finland in total		3 %	4 %	12 %	12 %	19 %	17 %	12 %	11 %	10 %

The housing age is quite standard across the country, with only slight deviations. The newest homes are situated in the Helsinki-Uusimaa province and the oldest homes in the counties of northern- and eastern Finland.

H08: Households with arrears on their electricity bills likely suffer from energy poverty

Statistics Finland or other Finnish institutions do not measure energy poverty indicators, such as arrears on electricity bills. This is a missing indicator also raised in previous research by Assist (2017) and Gullman (2018).

5.4. Summary of multidimensional analysis

H09: Energy poverty is challenging for households with low ability to fight it

The previous research concludes that the highest risk goes hand in hand with the lowest ability to fight energy poverty. Even though we are not able to conclude with data where energy poverty for certain is the highest, we can conclude where the risk most likely is based on previous research.

In order to quantify the previous hypotheses, the above made studies will be put together in the following manner:

- Each province and county will be comparatively analyzed, by giving points for counties 1–4 and provinces 1–18. The lower the point, the lower the risk;
- Each indicator will be measured comparatively between the counties and provinces;
- The county and province with the highest score have the highest likelihood of residents suffering from energy poverty, compared to the other counties and provinces.

The grading results are found as attachment 1.

In picture 12 below is a summarized comparative result where the above analyzed results have been counted together without giving weight to any of the indicators. The study shows that the county with the highest risk of having energy poverty issues among its citizens is southern Finland. This is due to a high share of aging population, together with high amounts of older detached homes.

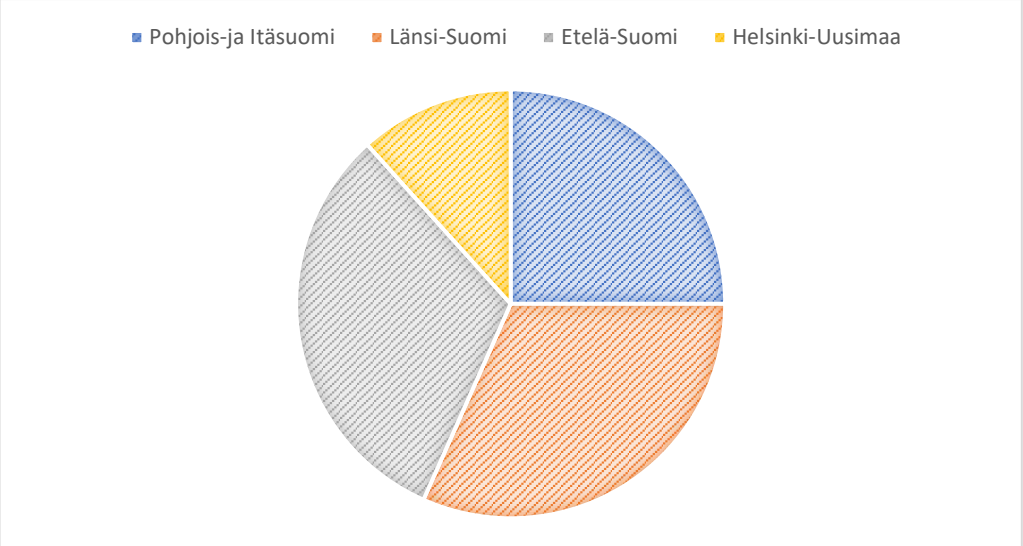

Figure 12 Comparative multidimensional analysis of the counties with the highest risk of energy poverty.

The province with the highest indicated comparative risk of its residents suffering from energy poverty is the Satakunta province as pictured below in picture 13. The provinces of Kymenlaakso and Kainuu are close behind.

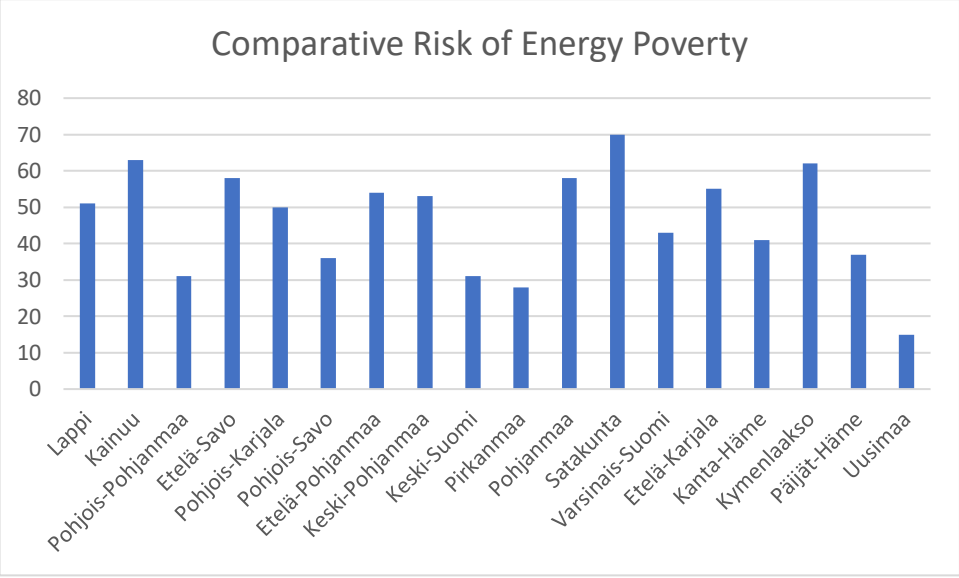

Figure 13 Comparative multidimensional analysis of the provinces with the highest risk of energy poverty.

The research is not able to at this stage prove or disprove if these regions indeed are suffering comparatively the most of energy poverty. The research shows where the risk is the highest, based on hypothesis from previous research. The research of actual correlation with energy poverty is not possible due to the lack of energy poverty or deprivation measurements in Finland.

6. Reflection of the results

6.1. Policy implications and the future of energy poverty in Finland

According to the European Commission Energy Poverty Observatory, the levels of energy poverty in Finland are comparatively low with other EU member states. The EPOV data shows that energy poverty indicators in Finland are between 2–4 % (European Commission 2019.) At the same time, previous studies on energy poverty in Finland admit that energy poverty is not recognized as a prob and that the understanding of its extent and consequences are inadequate (Gullman 2018, 23).

As a response to the European Commission and regulation (EU) 2018/1999 of the European Parliament and of the Council, published 11 December 2018, on the Governance of the Energy Union and Climate Action, the Finnish Ministry of Economic Affairs and Employment concludes that Finland does not have, nor does the regulation require Finland to have national initiatives for reducing energy poverty:

> *"In Finland there is not a significant number of households, which would suffer from energy poverty…Finland does not have national indicative objectives to reduce energy poverty"*
>
> (Finnish Ministry of Economic Affairs and Employment 2018, 32 & 62)

Although the ministry concludes that no direct policy measures exist, nor is there a plan to apply policy measures for energy poverty, the issue is recognized in Finland based on previous research:

> *"The risk group for energy poverty mainly focuses on low-income households living in large non-energy-efficient dwellings outside urban areas."*
>
> (Finnish Ministry of Economic Affairs and Employment 2018,38–39)

The ministry concludes, as a response to the European Commission, that they recognize measures already taken and conclude them to be enough:

> *"In Finland, energy poverty is in the current practice discussed as part of general social policy, which secures the right of all citizens especially to basic necessities such as energy…there is already a very comprehensive social support system in Finland designed to guarantee a minimum income for all. There are no subsidies specifically targeted at energy poverty, but as an aid to mitigate energy poverty can be considered such subsidies that reduce housing expenditure or are targeted to meet basic needs such as energy costs. These subsidies include, for example, housing allowance and livelihood support. In addition to these direct subsidies, household allowance to deduct home renovation costs in taxation is also an aid for reducing energy poverty"*
>
> (Finnish Ministry of Economic Affairs and Employment 2018, 38)

These current comprehensive social support systems in Finland are also recognized by previous research. To summarize, the current support schemes include (Oja et.al 2013):

- Housing benefits for vulnerable customers, students and pensioners;
- Income support for vulnerable customers;
- Tax benefit, or domestic help credit on energy efficiency investments;
- Repair and energy subsidies granted by municipalities;
- Concessional loans;
- Consumer energy advice programs.

As the last measure, the Finnish Ministry of Economic Affairs and Employment point out the "supplier of last resort" or steps for a vulnerable customer to appeal to their rights before cutting power, also recognized by CEER (2012). The ministry refers to this program in their response to the European Commission:

> *"The consumer is protected by the obligation imposed on the energy company to limit cut off of electricity, especially in the winter. Due to unpaid bills, electricity distribution can usually be cut off five weeks after the customer has been reminded. During the winter months (October to April), due to the negligence of a customer, electricity distribution will not be cut off in a permanent home which heating is dependent on electricity until four months have elapsed since the due date of the payment"*
>
> (Finnish Ministry of Economic Affairs and Employment 2018, 39).

In order to reflect upon the welfare efforts in Finland and their direct or indirect impact on energy efficiency, we can summarize the results with the categorization made earlier in table 8 below.

Based on the categorization one could make an empirical assumption that the social and welfare support system in Finland does in fact cover a wide range of the energy poverty factors recognized by previous research.

Table 8 Categorization of policy efforts in Finland

	Impact through direct policy efforts	**Issues less sensitive to direct policy efforts**
Socio-economic status Poverty and deprivation Unemployment Income of students Income of senior citizens	Income support for vulnerable customers;	Consumer energy advice programs;
Cost of goods: Energy prices	Housing benefits for vulnerable customers, students and pensioners; Supplier of last resort;	
Schooling & welfare: Inability to fight energy poverty		Consumer energy advice programs;
Living of individuals: Energy consumption levels/energy efficiency Living distances Sources of energy and heating types Age of housing Type of housing	Housing benefits for vulnerable customers, students and pensioners;	Tax benefit, or domestic help credit on energy efficiency investments; Repair and energy subsidies granted by municipalities; Concessional loans;
Other:		Ministry response to CEP requirements;

While the estimated energy poverty levels are currently low, there are many risks and questions that remain unanswered. Together with other researchers, Bouzarovski & Herrero recognize Finland as part of the relatively steady group of low energy poverty countries in the Northern and Western Europe but warn that the low levels of energy poverty will not remain without recognizing the issue. They point out the risk that increasing energy prices impose when growing faster than inflation rates in these regions (2019, 82). The research group Assist2gether make similar remarks and warn that we do not know for certain that the current social welfare efforts are enough (Assist2Gether 2018, 10).

6.2. Reflection to research questions and results

The first research question stated: “Which European indicators of energy poverty causes are valid in the Finnish scope?”

It seems that this is the research question most challenging to conclude. Although we have been able to make assumptions energy poverty indicators in Finland and conclude in the second research question that there is regionality – we are not able to confirm the assumptions with a correlation to measured energy poverty levels. This is an indicator missing from the national statistics center and lacking on adequately accurate measurements on the EU level.

The indicators found in previous research, where the correlation with energy poverty has been confirmed in western countries, we can find satisfactory results in Finland and confirm that they all are valid.

The second research question stated: “What is the regional significance of the causes of energy poverty – or the risk of them – in Finland?”

Although we can’t conclude for certain where energy poverty is at its highest levels in Finland, we can conclude that there is clear regionality in the hypotheses from previous research, indicating a risk for falling into energy poverty.

The third and final research question stated: “What are the implications of policies already taken, or not yet taken, in Finland?”

As concluded in chapter 5, there are policy measures and schemes in place that indirectly alleviate energy poverty in Finland. Since Finland is a country with comprehensive social welfare structures, energy poverty can be assumed to be covered by them.

At the same time, we do not know for certain, since energy poverty is a phenomenon not recognized in any legislation or measures separately – nor is it measured to be reacted upon.

To conclude, what do we know now based on this research?

Based on this research we can conclude together with previous research that Finland is a well-off country, also regarding energy poverty. The policy measures seem to be comprehensive and the government does not seem to recognize a high risk in energy poverty.

In the qualitative part of this research we recognized that there are many indicators of the causes for energy poverty, or indicators of socio-economic groups where energy poverty has a high risk in western countries. Through the comparative section of this research, we concluded that the risk is regionally different, by recognizing and comparing the indicators in each region with each other.

Agreeing with previous research, we can conclude that even though Finland is a well-off country, there is a growing national and regional risk of energy poverty, due to the increasing costs of energy.

What don’t we know and what remains to be answered through future research?

Previous research of energy poverty confirms the indicators and factors found with actual energy poverty levels of each country. Since there are no accurate results, this has not been possible in this research. Due to this there are indicators and extensive work in confirming the assumptions to be made in future research.

The main measurements would be the ones suggested by the European Commission Energy Poverty Observatory - arrears on energy bills and the actual levels of energy poverty.

With these indicators, future research could answer questions around the hypotheses concluded in this research:

Are some socio-economic groups suffering from energy poverty without us knowing?

Can we confirm and know for certain that the social welfare measures taken in Finland are enough to alleviate energy poverty?

Are there other correlations and Finland specific energy poverty indicators, completely missed by this and other previous research?

The final two questions that have not been answered during this research, but would be interesting for future research are:

What are the consequences of energy poverty in Finland? One can only imagine that the cold winters and hot summers are only amplifying the consequences of energy poverty.

If energy poverty goes hand in hand with general poverty, why are the numbers so different?

The measured poverty level for Finland, with the OECD poverty scale of 60% under national median income is in the year 2017 at 13,8 % and according to the old OECD scale at 50% under national median income in the year 2017 at around 7 % (Kauhanen et.al 2020, 14–17). This does not correlate with estimated energy poverty levels, but why?

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Attachments

Attachment 1.

INDICATOR ANALYSIS		Population density	Detached homes	Age of housing	Amount of elderly	Energy cost	Energy source	Total
Pohjois-ja Itäsuomi		**4**	3	2	3	2	1	15
	Lappi	18	14	4	9		6	51
	Kainuu	17	13	15	17		1	63
	Pohjois-Pohjanmaa	14	9	1	2		5	31
	Etelä-Savo	15	11	10	18		4	58
	Pohjois-Karjala	16	12	7	13		2	50
	Pohjois-Savo	11	5	9	8		3	36
Länsi-Suomi		**3**	4	3	2	3	4	19
	Etelä-Pohjanmaa	12	17	2	11		12	54
	Keski-Pohjanmaa	13	17	4	5		14	53
	Keski-Suomi	10	5	3	5		8	31
	Pirkanmaa	3	2	8	3		12	28
	Pohjanmaa	9	15	12	4		18	58
	Satakunta	7	16	17	14		16	70
	Varsinais-Suomi	2	4	15	7		15	43
Etelä-Suomi		**2**	2	4	4	4	3	19
	Etelä-Karjala	8	9	12	15		11	55
	Kanta-Häme	6	7	11	9		8	41
	Kymenlaakso	5	7	18	16		16	62
	Päijät-Häme	4	3	12	11		7	37
Helsinki-Uusimaa		**1**	1	1	1	1	2	7
	Uusimaa	1	1	4	1		8	15